98TH CONGRESS
2d Session

HOUSE OF REPRESENTATIVES

REPORT
98-686

DEPARTMENT OF ENERGY CIVILIAN RESEARCH AND DEVELOPMENT AUTHORIZATION ACT FOR FISCAL YEARS 1985, 1986, AND 1987

APRIL 12, 1984.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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Mr. FUQUA, from the Committee on Science and Technology, submitted the following

REPORT

together with

ADDITIONAL AND MINORITY VIEWS

[To accompany H.R. 5244]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science and Technology, to whom was referred the bill (H.R. 5244) to authorize appropriations to the Department of Energy for civilian research and development programs for the fiscal years 1985, 1986, and 1987 and for the continuation in those fiscal years of prior year research and development projects, having considered the same, report favorably thereon with amendments and recommend that the bill as amended do pass.

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The amendments are as follows:

On page 2, line 13, strike "$367,960,000" and insert in lieu thereof "$369,210,000"; and on line 15, strike "$235,704,000" and insert in lieu thereof "$231,254,000";

On page 4, line 8, strike "$81,000,000" and insert in lieu thereof "$83,000,000"; and on line 11, strike "$428,938,000" and insert in lieu thereof "$426,438,000";

On page 14, line 13, strike "$1,885,552,000" and insert in lieu thereof "$1,892,552,000"; and on line 15, strike "$1,939,512,000" and insert in lieu thereof "$1,940,812,000"; and

On page 15, after line 21, insert the following new paragraph:

"(2) Energy Conservation,

(A) Project numbered 84-CS-101, High Temperature Materials Laboratory, Oak Ridge, Tennessee, $2,700,000, for a total authorization of $19,300,000;"

and renumber the succeeding paragraphs accordingly.

I. BACKGROUND OF THE BILL

The fiscal year 1985 Department of Energy budget was submitted to the House of Representatives on February 1, 1984 by President Reagan. The formal authorization request in bill form for the DOE civilian energy programs was submitted on March 9, 1984.

On March 24, 1984, Chairman Don Fuqua introduced a bill, H.R. 5244, to authorize appropriations to the Department of Energy for civilian research and development programs and projects for fiscal years 1985, 1986, and 1987. This bill was referred to the Committee on Science and Technology.

Extensive hearings were held during February and March 1984 on the Department of Energy authorization requests. On March 27 and April 3, 1984, the Committee met to mark-up the bill. After completing this action, the Committee reported the bill, H.R. 5244, as amended, on April 3, 1984 by a recorded vote, 26 yeas, 14 nays.

II. HEARINGS

A. Subcommittee on Energy Development and Applications

The Subcommittee on Energy Development and Applications held hearings on the fiscal year 1985 Department of Energy (DOE) authorization for fossil energy, energy conservation, solar energy, geothermal energy, supporting research and technical analysis, and general science and research programs on February 22, 23, 28, 29, and March 1, 6, 7, 8, 1984.

Members of Congress who testified included Hon. Nick J. Rahall, II (D–WV) and Hon. Doug Walgren (D–PA).

DOE officials who testified included: Dr. Alvin W. Trivelpiece, Director of the Office of Energy Research, accompanied by Dr. James Leiss, Associate Director of the Office of High Energy and Nuclear Physics, Dr. Richard H. Kropschot, associate Director of the Office of Basic Energy Sciences, and Ms. Antoinette Joseph, Director of the Office of Field Operations Management; Hon. Pat Collins, Under Secretary of Energy and Acting Assistant Secretary for Conservation and Renewable Energy, accompanied by Ms. Donna Fitzpatrick, Principal Deputy Assistant Secretary for Conservation and Renewable Energy, Mr. John Milhone, Acting Deputy Assistant Secretary for Conservation, and Dr. Robert San Martin, Deputy Assistant Secretary for Solar and Renewable Energy; Hon. William A. Vaughan, Assistant Secretary for Fossil Energy, accompanied by Mr. Donald Bauer, Principal Deputy Assistant Secretary for Fossil Energy, and Mr. J.E. Walsh, Jr., Deputy Assistant Secretary for Management, Planning and Technical Coordination; and Ms. Martha Hesse, Assistant Secretary for Management and Administration.

In addition, the following citizens testified: Professor Maury Tigner, Director of Operations for the Wilson Synchrotron Laboratory at Cornell University; Dr. Leon M. Lederman, Director of Fermi National Accelerator Laboratory; Dr. Burton Richter, Technical Director of the Stanford Linear Accelerator Center; Dr. John P. Schiffer of Argonne National Laboratory; Professor Sam Austin of the Cyclotron Laboratory at Michigan State University; Professor Harry D. Holmgren of the University of Maryland, accompanied by Professor James S. McCarthy of the University of Virginia; Professor George Pimentel, Associate Director of the Chemical Biodynamics Division of Lawrence Berkeley Laboratory; Dr. Albert Narath, Executive Vice President of Sandia National Laboratories; Dr. Peter Eisenberger, Director of the Physical Sciences Laboratory of Exxon Research and Engineering Company; Dr. M.L Knotek of Sandia National Laboratories; Dr. Hermann A. Grunder, Associate Director of the Accelerator and Fusion Research Division of Lawrence Berkeley Laboratory, accompanied by Dr. Gabor A. Somorjai of the Center for Advanced Materials at Lawrence Berkeley Labo-

ratory; Dr. Robert H. Pry, Vice Chairman for Technology of Gould, Inc.; Dr. Frederick Seitz of Rockefeller University; Dr. Paul Berdahl of Lawrence Berkeley Laboratory; Mr. Peter Johnson of the Office of Technology Assessment; Dr. Sidney I. Firstman, President of the Biomass Energy Research Association; Dr. Lloyd R. Lawrence of Mechanical Technology, Inc.; Mr. Harry L. Brown of the Materials Science Division of EG&G Idaho, Inc.; Dr. Jay Desai of the General Electric Company; Dr. Roger Carlsmith, Director of the Conservation Division of Oak Ridge National Laboratory; Mr. John J. Mattimoe, General Manager of the Sacramento Municipal Utility District; Dr. Donald L. Feucht, Deputy Director of the Solar Energy Research Institute; Dr. Harry S. Zwibel, Director of the New Mexico Solar Energy Institute; Dr. Charles Gay of ARCO Solar; Mr. Frank Duquette of McDonnell Douglas Astronautics Company, accompanied by Mr. Tom Springer of Rockwell International Corporation; Mr. Fred Goldsberry, Chief Engineer of Zapata Exploration Company; Mr. John T. Whetten of the Earth and Space Science Division of Los Alamos National Laboratory; Mr. Ralph Knobel, Director of the National Energy Extension Service Advisory Board; Mr. Robert D. Lynch, Vice President of the Empire State Petroleum Association, Inc.; Mr. Mortimer M. Marshall of the National Institute of Building Sciences; Mr. Thomas Vonier of the American Insitute of Architects; Mr. Michael High, Director of the Division of Energy Demonstrations and Technology of the Tennessee Valley Authority; Dr. Richard D. Wolfe, Vice President for Research and Development of the United Coal Company; Dr. George W. Roberts, Director of the Commercial Development Division of Air Products and Chemicals, Inc.; Kurt Yeager, Vice President for Coal Combustion Systems of the Electric Power Research Institute; Mr. William H. Podolny United Technology Corporation; Mr. Robert W. Fri, Executive Director of the Fuel Cell Users Group; Dr. Bernard S. Baker, President of the Energy Research Corporation; Mr. Fritz Kalhammer, Vice President for Energy Management and Utilization of the Electric Power Research Institute; Dr. Bernard S. Lee, President of the Institute of Gas Technology; Mr. William Morse, Director of Research for Columbia Gas Systems, accompanied by Mr. Michael Baly, III, Vice President of the American Gas Association; Mr. David O. Webb, Senior Vice President for Policy and Regulatory Affairs of the Gas Research Institute; Mr. John Robert Friday, Vice President for Research and Development of Lummus Crest; Mr. Frank C. Schora, President of HYCRUDE; Mr Joseph A. McElwain, Chairman of the Board of Montana Power Company; and Mr. S.R. Hart, Jr., Vice President for Research and Development of Southern Company Services, Inc.

B. Subcommittee on Natural Resources, Agriculture Research and Environment

The Subcommittee on Natural Resources, Agriculture Research and Environment held hearings on the Department of Energy's FY 1985 budget request for environmental programs on March 6 and 13, 1984. A budget authorization hearing was held March 15, 1984.

DOE officials who testified included: Dr. Alvin Trivelpiece, Director, Office of Energy Research; Dr. Charles Edington, Associate Director, Office of Biological and Environmental Research; Mr. Jan W. Mares, Assistant Secretary for Policy, Safety, and Environment; and Mr. Robert W. Davies, the Deputy Assistant Secretary for Environment, Safety and Health.

In addition to DOE officials, testimony was received from: Dr. Edward L. Alpen, Director of the Donner Laboratory of the Lawerence Berkeley Laboratory; Dr. Thomas Hayes, Assistant Director of the Donner Laboratory of the Lawrence Berkeley Laboratory; Dr. Michael E. Phelps, Chief of Biophysics, University of California at Los Angeles, School of Medicine; Dr. Victor P. Bond, Associate Laboratory Director for the Biomedical and Environmental Sciences at Brookhaven National Laboratory; Dr. Warren K. Sinclair, President to the National Council on Radiation Protection and Measurements; Dr. Chester R. Richmond, Associate Laboratory Director for Biomedical and Enviromental Sciences at Oak Ridge National Laboratory; and the Honorable Guy Molinari, United States House of Representatives.

C. Subcommittee on Energy Research and Production

The Subcommittee on Energy Research and Production held hearings on the fiscal year 1985 Department of Energy budget request for the Nuclear Fission R&D program, including an overview of the program and discussions on the Breeder Reactor Base Program, Fuel Cycle R&D, and Converter Reactor Systems, Special Nuclear Fission Topics, including Advanced Reactor Systems, Nuclear Waste Management, Uranium Enrichment Activities, Magnetic Fusion Energy, Electric Energy Systems, Energy Storage Systems, Small-Scale Hydropower and Departmental Administration. The hearings were held on February 7, 8, 9, 22, 23, 28 and 29, March 7 and 13, 1984.

DOE officials who testified included: Dr. Shelby T. Brewer, Assistant Secretary for Nuclear Energy; Mr. Michael J. Lawrence, Acting Director, Office of Civilian Radioactive Waste Management; Dr. Franklin E. Coffman, Director, Office of Terminal Waste Disposal and Remedial Action; Mr. John R. Longenecker, Deputy Assistant Secretary for Uranium Enrichment; Dr. Alvin T. Trivelpiece, Director, Office of Energy Research; Dr. John F. Clarke, Associate Director for Fusion Energy, Office of Energy Research; Mr. Ronald Davidson, Chairman, Magnetic Fusion Advisory Committee; Hon. Pat Collins, Undersecretary; and Ms. Martha O. Hesse, Assistant Secretary, Management and Administration.

In addition to DOE officials, testimony was also received from: Dr. Alvin Weinberg, Institute for Energy Analysis; Dr. Richard K. Lester, Department of Nuclear Engineering; Massachusetts Institute of Technology; Mr. Charles Jones, President of NUS Corporation; Mr. Fredrick Webber, Edison Electric Institute; Dr. E. A. Evans, Technical Director, Hanford Engineering Development Laboratory; Mr. Donald Trauger, Associate Director for Nuclear & Engineering Technologies, Oak Ridge National Laboratory; Mr. Paul Kasten, Oak Ridge National Laboratory; Mr. George Dilworth, Assistant Manager, Tennessee Valley Authority; Mr. Jim Dager, Vice

President of Engineering, Projects and Construction, Florida Power and Light Company; Dr. John Gibbons, Director, Office of Technology Assessment, Dr. Carl Behrens, Congressional Research Service; Dr. Harold Agnew, President, GA Technologies Inc.; Dr. Charles Storrs, Director, Advanced Development, C-E Power Systems, Combustion Engineering, Inc.; Mr. Richard Walker, President and Chief Executive Office, Public Services Company of Colorado; Dr. Wm. Howard Arnold, General Manager, Advanced Reactors Division, Westinghouse Electric Corporation; Mr. R. O. Williams, President, Energy System Group, Rockwell International; Dr. Bertram Wolfe, General Electric Company; Dr. Charles Till, Associate Laboratory Director for Reactor Research and Development, Argonne National Laboratory; Mr. John C. Young, President, International Energy Associates Limited; Dr. William Wright, Defense Advanced Research Projects Agency; Dr. Jay E. Boudreau, Deputy Associate Director, Nuclear Programs, Los Alamos National Laboratory; Hon. James F. McNulty, Jr. (D-AZ), U.S. House of Representatives; Mr. Donald B. Mausshardt, Deputy Director, Office of Nuclear Material Safety & Safeguards, Nuclear Regulatory Commission; Mr. Sherwood Smith, Chief Executive Officer, Carolina Power and Light representing Edison Electric Institute; Mr. Leo Duffy, General Manager, Waste Technology Services Division, Westinghouse Electric Corporation; Mr. Warren P. Chernock, Vice President, Development Nuclear Power Systems, C-E Power Systems, Combustion Engineering, Inc.; Mr. Charles Rowan, Garrett Corporation; Mr. Richard L. Grant, President, Boeing Engineering & Construction South-East, Inc.; Dr. E. O. Hartig, Vice President, Goodyear Aerospace Corporation; Dr. John L. Emmett, Associate Director, Lawrence Livermore National Laboratory; Mr. William McWhorter, Program Manager, Advanced Gas Centrifuge Program, Union Carbide Corporation; Mr. George Rifakes, Vice President, Commonwealth Edison Electric representing the Edison Electric Institute; Dr. Harold Furth, Director, Princeton Plasma Physics Laboratory; Dr. Tihiro Ohkawa, Vice President, GA Technologies Inc.; Dr. Charles Baker, Director, Fusion Power Program, Argonne National Laboratory; Dr. Carl Henning, Associate Program Leader for Fusion Development & Technology, Lawrence Livermore Laboratory; Dr. Allan T. Mense, McDonnell Douglas Astronautics Company representing the Institute of Electrical & Electronics Engineers, Inc.; Mr. Leonard F. C. Reichle, Executive Vice President, EBASCO, Inc.; Dr. Robert A. Gross, Dean of SEAS, Columbia University; Dr. Stephen O. Dean, Fusion Power Associates; Mr. Harold Motchan, McDonnell Douglas Astronautics Company; Dr. Ramy Shanny, INESCO, Inc.; Ms. Marsha Freeman, Fusion Energy Foundation; Dr. Fritz Kalhammer, Electric Power Research Institute; Mr. Lowell J. Endahl, National Rural Electric Cooperative Association; Mr. Donald J. Helfrecht, Wisconsin Electric Utility Research Foundation; Mr. William Feero, Institute of Electrical & Electronics Engineers, Inc.; Mr. Roger Carlsmith, Oak Ridge National Laboratory; Dr. Elton Cairns, Lawrence Berkeley Laboratory; and Dr. Roger Boom, University of Wisconsin.

D. Subcommittee on Transportation, Aviation and Materials

The Subcommittee on Transportation, Aviation and Materials held budget authorization hearings on February 21 and 22, 1984 on the Department of Energy's Transportation Programs.

Witnesses included:

Mr. Pat Collins, Under Secretary, U.S. Department of Energy; accompanied by: Ms. Donna R. Fitzpatrick, Principal Deputy Assistant Secretary for Conservation and Renewables; Mr. Alan J. Streb, Acting Deputy Assistant Secretary for Conservation; Mr. Paul J. Brown, Acting Director, Office of Vehicle and Engine Research and Development.

Mr. Noel P. Nightingale, Program Manager, Automotive Stirling Engine Development Program, Mechanical Technology Incorporated; accompanied by: Mr. Edward S. Wright, Manager, Government Products, and Vice President, John Deere Technologies International, Inc., Deere & Company; Mr. Bruce Goldwater, General Manager, Stirling Engine Systems Division, Mechanical Technology Incorporated.

Dr. James I. Mueller, Professor, Ceramic Engineering, Department of Materials Science and Engineering, University of Washington.

Mr. John Boppart, Vice President, Engineering, Garrett Turbine Engine Company, The Garrett Corporation.

Dr. Ian Macpherson, Director, Powertrain Research, Ford Motor Company.

Mr. Harold E. Helms, Chief Project Engineer, Vehicular Turbines, Allison Gas Turbine Operations, General Motors Corporation.

Mr. Gerald H. Mader, Executive Vice President, Electric Vehicle Development Corporation.

III. SUMMARY OF COMMITTEE ACTIONS

Fiscal Year 1985 Department of Energy Authorization—Summary of Committee Actions

TITLE 1—FISCAL YEAR 1985 ENERGY R&D PROGRAMS

[In thousands of dollars]

	Fiscal year 1984 budget authority (estimate)	Fiscal year 1985 DOE request	Committee action	
			Changes to DOE request	Total authorization
Fossil energy:				
Operating expenses	323,040	263,370	+51,175	314,545
Capital equipment	1,500	4,500	.....	4,500
Construction	5,040	5,000	.....	5,000
Total, fossil energy	329,580	272,870	+51,175	324,045
Energy conservation:				
Operating expenses	132,135	106,498	+31,000	137,498
Capital equipment	1,500	13,300	−7,650	5,650
Construction	9,000	10,600	−4,000	6,600
Total, conservation	142,635	130,398	+19,350	149,748
Energy Supply R&D:				
Solar Energy:				
Operating expenses	176,150	154,249	+22,836	177,085
Capital equipment	250	2,900	.....	2,900
Construction	1,500	0	+10,500	10,500
Total, solar energy	177,900	157,149	+33,336	190,485
Geothermal energy:				
Operating expenses	30,459	26,687	+5,500	32,187
Capital equipment	0	400	.....	400
Construction	0	0	.....	0
Total, geothermal	30,459	27,087	+5,500	32,587
Nuclear fission (supply R&D):				
Operating expenses	518,682	425,681	+27,191	452,872
Capital equipment	32,200	25,575	+1,500	27,075
Construction	16,100	7,800	.....	7,800
Total, nuclear fission supply R&D	566,982	459,056	+28,691	487,747
Magnetic fusion energy:				
Operating expenses	396,450	417,238	+9,200	426,438
Capital equipment	37,800	33,400	.....	33,400
Construction	36,500	32,500	.....	32,500
Total, magnetic fusion	470,750	483,138	+9,200	492,338
Electric energy systems and energy storage systems:				
Operating expenses	44,200	34,535	+4,665	39,200
Capital equipment	0	800	.....	800

	Fiscal year 1984 budget authority (estimate)	Fiscal year 1985 DOE request	Committee action	
			Changes to DOE request	Total authorization
Total, EES/ESS	44,200	35,335	+4,665	40,000
Supporting research and technical analysis:				
Operating expenses	311,569	369,440	−230	369,210
Capital equipment	24,280	31,120		31,120
Construction	59,260	79,020		79,020
Total, supporting research	395,109	479,580	−230	479,350
Environmental R&D:				
Operating expenses	207,005	215,704	+15,550	231,254
Capital equipment	9,900	9,500		9,500
Construction	2,400	3,000		3,000
Total, environmental R&D	219,305	228,204	+15,550	243,754
Policy and management, energy research: Operating expenses, total	1,288	530		530
Geothermal resources development fund (GRDF): Operating expenses, total	2,100	121		121
General science and research:				
Operating expenses	478,750	528,405		528,405
Capital equipment	62,800	79,100		79,100
Construction	99,700	139,300		139,300
Total, general science	641,250	746,805		746,805
Nuclear fission (uranium enrichment R&D):				
Operating expenses	172,800	140,800	[1] +32,000	[1] 172,800
Capital equipment	12,900	8,700		8,700
Construction	3,600	500		500
Total, uranium enrichment R&D	189,300	150,000	[1] +32,000	[1] 182,000
Total, Title I	3,210,858	3,170,273	[1] +199,237	[1] 3,369,510
New budget authority			+166,237	3,336,510

[1] $32 million increase for Uranium Enrichment R&D is the net action of a reduction of $1 million in new budget authority and an increase of $33 million which is to be provided from existing unobligated balances in the Uranium Enrichment account and not from new budget authority.

TITLE II—FISCAL YEARS 1986 AND 1987 ENERGY R&D PROGRAMS

[In thousands of dollars]

	Fiscal year—			
	1985 DOE request	1985 committee action	1986 committee action	1987 committee action
Fossil energy:				
Operating and capital equipment			345,500	357,000
Construction			3,000	3,500
Total	272,870	324,045	348,500	360,500
Energy conservation:				
Operating and capital equipment			166,100	159,100
Construction			2,700	0
Total	130,398	149,748	168,800	159,100

	Fiscal year—			
	1985 DOE request	1985 committee action	1986 committee action	1987 committee action
Energy supply R&D:				
Solar energy:				
Operating and capital equipment			192,800	202,700
Construction			9,000	0
Total	157,149	190,485	201,800	202,700
Geothermal energy:				
Operating and capital equipment			34,700	32,400
Construction			0	0
Total	27,087	32,587	34,700	32,400
Nuclear fission:				
Operating and capital equipment			452,735	410,585
Construction			52,600	82,300
Total	459,056	487,747	505,335	492,885
Magnetic fusion energy:				
Operating and capital equipment			466,000	495,000
Construction			51,000	53,000
Total	483,138	492,338	517,000	548,000
Electric energy systems and energy storage systems:				
Operating and capital equipment, total	35,335	40,000	49,000	45,300
Supporting research and technical analysis:				
Operating and capital equipment			439,300	483,900
Construction			79,500	68,160
Total	479,580	479,350	518,900	552,060
Environmental R&D:				
Operating and capital equipment			257,460	270,342
Construction			3,150	3,300
Total	228,204	243,754	260,610	273,642
Policy and management, energy research: Operating expenses, total	530	530	557	585
Subtotal, energy supply R&D	1,870,079	1,966,791	2,087,802	2,147,572
Geothermal resources development fund (GRDF):				
Operating expenses, total	121	121	121	121
General science and research:				
Operating and capital equipment			701,100	782,300
Construction			57,500	34,800
Total	746,805	746,805	758,600	817,100
Uranium enrichment R&D:				
Operating and capital equipment			170,000	170,000
Construction			0	0
Total	150,000	[1] 182,000	170,000	170,000
Total, title II	3,170,273	[1] 3,369,510	3,533,823	3,654,393

[1] $32 million increase in fiscal year 1985 for Uranium Enrichment R&D is the net action of a reduction of $1 million in new budget authority and an increase of $33 million which is to be provided from existing unobligated balances in the Uranium Enrichment account and not from new budget authority.

FOSSIL ENERGY: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $324,045,000 for fossil energy research and development, which is an increase of $51,175,000 over the Administration's request.

A. Operating expenses

In the specific subprograms, the Committee acted as follows:

1. Control technology.—Increased the Administration's request by $2,900,000 by decreasing the flue gas cleanup activity by $2,600,000, and increasing the gas stream cleanup activity by $1,500,000, coal preparation by $2,000,000, and cleanup base technology by $2,000,000.

2. Advanced research and technology development.—Increased the Administration's request by $2,000,000 to increase the direct utilization activity for fuel cells and redirected $2,500,000 from the processes, direct utilization, and technology cross-cut programs to long range materials work.

3. Coal liquefaction.—Increased the Administration's request by $9,200,000 to enhance indirect liquefaction by $3,650,000 and advanced process development by $5,550,000.

4. Combustion systems.—Decreased the Administration's request by $12,500,000 to provide an increase of $1,500,000 for use in atmospheric fluidized bed facilities and $1,000,000 for advanced combustion technology, and to reduce the request for the Tennessee Valley Authority (TVA) demonstration plant by $15,000,000. Funds for the TVA plant have already been appropriated.

5. Fuel cells.—Increased the Administration's request by $27,900,000 to continue the phosphoric acid, molten carbonate, and solid oxide programs at current levels.

6. Heat engines.—Increased the Administration's request by $5,000,000 to accelerate research on "fuel-flexible" turbines and coal-fired diesels.

7. Magnetohydrodynamics (MHD).—Increased the Administration's request by $7,000,000 to continue activity in the MHD program without large immediate cost sharing.

8. Surface coal gasification.—Increased the Administration's request by $6,500,000 to continue operating advanced gasifier facilities.

9. Advanced process technology.—Reduced the Administration's request by $700,000 to continue arctic and offshore technology at the fiscal year 1984 level.

10. Enhanced oil recovery.—Decreased the Administration's request by $2,125,000 to provide a 23 percent increase over FY 1984 in program funding.

11. Oil shale.—Increased the Administration's request by $2,000,000 for eastern shale technology.

12. Unconventional gas recovery.—Increased the Administration's request by $1,000,000 for eastern gas shales activity.

13. Fossil energy program direction.—Increased the Administration's request by $3,000,000 to allow for the return to personnel levels consistent with current programs and existing legislation.

ENERGY CONSERVATION: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $149,748,000 for energy conservation programs, which is an increase of $19,350,000 over the Administration's request.

A. Operating expenses

In the specific subprograms, the Committee acted as follows:

1. Buildings and community systems.—Increased the Administration's request by $8,500,000 for activities in building systems, community systems, and building equipment.

2. Industrial energy conservation.—Increased the Administration's request by $5,000,000 for waste energy reduction, industrial process efficiency, and industrial cogeneration.

3. Multi-sector.—Decreased the Administration's request by $4,000,000 for energy conservation technology.

4. Transportation energy conservation.—Increased the Administration's request by $21,500,000 for the gas turbine and Stirling engine programs and for battery research.

B. Plant and capital equipment

The Committee reduced the Administration's request for capital equipment by $1,100,000 in building and community systems, $4,400,000 in industrial energy conservation, and $2,150,000 in multi-sector. The Committee also decreased the Administration's request in transportation for construction of the High Temperature Materials Lab by $4,000,000 ($1,300,000 reduction in FY 1985 and $2,700,000 deferral to FY 1986).

SOLAR ENERGY: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $190,485,000 for solar energy programs, which is an increase of $33,336,000 over the Administration's request.

A. Operating expenses

In the specific subprograms, the Committee acted as follows:

1. Photovoltaic energy systems.—Increased the Administration's request by a net of $5,000,000 by decreasing materials research by $1,500,000 and increasing systems research by $6,500,000.

2. Solar thermal energy systems.—Increased the Administration's request by $7,000,000 by increasing central receiver R&D, distributed receiver R&D, and planning and assessment activities by $9,000,000 and decreasing materials and components by $2,000,000.

3. Solar building energy research.—Increased the Administration's request by $6,400,000 for materials and components R&D and for systems analysis and thermal science.

4. Wind energy systems.—Reduced the Administration's request by $5,500,000 by reducing aerodynamics and structural dynamics research by $6,500,000 and initiating a $1,000,000 cost-shared R&D program for small and intermediate size machines.

5. Biofuels energy systems.—Increased the Administration's request by $5,100,000 by increasing thermochemical and biochemical conversion , conversion technology transfer, and regional biomass

programs by $6,100,000 and decreasing production research by $1,000,000.

6. Ocean energy systems.—Increased the Administration's request by $2,500,000 to continue all program elements at current levels.

7. Solar resource assessment.—Increased the Administration's request for this activitiy by $2,200,000 and identified it as separate line item.

8. Program direction.—Increased the Administration's request by $136,000.

B. Plant and capital equipment

The Committee provided $9,500,000 for phase III construction funds for the Sacramento Municipal Utility District (SMUD) photovoltaics project and $1,000,000 to design a Solar Energy Research Institute (SERI) laboratory facility.

GEOTHERMAL ENERGY: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $32,587,000 for geothermal research and development, which is an increase of $5,500,000 over the Administration's request.

A. Operating expenses

In the specific subprograms, the Committee acted as follows:

1. Geopressured resources.—Increased the Administration's request by $3,500,000 to continue the well testing program and acquire and test a deep well.

2. Geothermal technology.—Increased the Administration's request by $2,000,000 to complete the hot dry rock research program.

NUCLEAR FISSION ENERGY (SUPPLY R&D): SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $487,747,000 for the nuclear fission energy (supply R&D) program which is an increase of $28,691,000 over the Administration request.

A. Operating expenses

In the specific subprograms, the Committee acted as follows:

1. Converter reactor systems.—Increased the Administration request by $31,691,000 for activities associated with the High Temperature Gas-Cooled Reactor (HTGR) Program, Light Water Reactor Systems, and Advanced Reactor Designs.

2. Nuclear waste technology treatment.—Agreed to the Administration request of $6,300,000.

3. Civilian radioactive waste management.—Agreed to the Administration request of $27,640,000.

4. Advanced nuclear systems.—Increased the Administration request by $5,000,000 for future development of the Space Nuclear Reactor (SP–100) program.

5. Breeder reactor systems.—Decreased the Administration request by $14,500,000. This decrease represents a reduction of $35,000,000 in the base breeder program, of which $20,000,000 will be redirected to the Fuel Cycle program in support of the Breeder Reprocessing Engineering Test (BRET) program and $500,000 will

be redirected for an evaluation of a "dry" separation process for reprocessing spent nuclear fuel from light water reactors. A total of $3,000,000 will be added to continue activities in support of the thorium/uranium cycle. The Committee decreased the Water-Cooled Breeder Reactor program by $3,000,000.

6. University program.—The Committee authorized $5,000,000 for a new initiative for the purpose of extending and strengthening the role of universities in the Department of Energy's nuclear fission R&D programs.

B. Plant and capital equipment

The Committee increased the Administration request by $1.5 million for component testing for the High Temperature Gas-Cooled Reactor (HTGR) program.

MAGNETIC FUSION ENERGY: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $492,338,000 for the Magnetic Fusion Program which is $9,200,000 over the Administration request of $438,138,000.

A. Operating expenses

The increase was added to Confinement Systems to enhance the Tokamak Fusion Core Experiment (TFCX). A redirection of $2,500,000 was authorized for a cost-shared fabrication of high-strength, high conductivity, copper magnetic coils for use in compact toroid ignition experiments.

ELECTRIC ENERGY SYSTEMS AND ENERGY STORAGE SYSTEMS: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $40,000,000 for the programs of Electric Energy Systems and Energy Storage Systems which is $4,665,000 over the Administration request of $35,335,000.

A. Operating expenses

1. Electric energy systems.—Increased the Administration request by $268,000 to maintain base level of activity and staffing.

2. Energy storage systems.—Increased the Administration request by $4,397,000 to conduct work in nine specific activities and to provide adequate staffing.

SUPPORTING RESEARCH AND TECHNICAL ANALYSIS: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $479,350,000 for Supporting Research and Technical Analysis programs, which is $230,000 less than the Administrations's request.

A. Operating expenses

In the specific programs, the Committee acted as follows:

1. Basic energy science.—The Committee reduced photon and optical R&D funding at Lawrence Berkeley Laboratory by $1,300,000.

2. University research support.—The Committee increased the Administration's request by $1,070,000 by increasing University Reac-

tor Fuel Assistance by $1,250,000 to study the conversion of reactors currently using highly enriched uranium to low enriched uranium, and reducing the Administration's request for Energy Manpower Assessments by $180,000 to maintain the program at the fiscal year 1984 appropriation.

ENVIRONMENTAL R&D: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $243,754,000 for environmental programs, which is an increase of $15,550,000 over the Administration's request.

A. Operating expenses

In the specific subprograms the Committee acted as follows:

1. Environment, safety and health.—Decreased the Administration's request by $2,000,000 to slow the rate of growth in the nuclear safety element. The amount decreased ($2,000,000) was redirected to the Biological and Environmental research program.

2. Biological/environmental research.—Increased the Administration's request by $17,550,000 to maintain long-term research in the areas of human disease, including cancer and cardiovascular studies, high altitude monitoring and risk assessment. The Committee also directed that $15,000,000 of the increase in this program be utilized to maintain the level of health effects research efforts at five dedicated laboratories.

GENERAL SCIENCE AND RESEARCH: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $746,805,000 for general science and research, which is in agreement with the Administration's request.

NUCLEAR FISSION (URANIUM ENRICHMENT R&D): SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $182,000,000 for the Nuclear Fission Uranium Enrichment R&D program which is an increase of $32,000,000 over the Administration request. The $32,000,000 increase is a net action of a reduction of $1,000,000 in new budget authority and an increase of $33,000,000 which is to be provided from existing unobligated balances in the Uranium Enrichment account and not from new budget authority.

IV. EXPLANATION OF PROGRAMS CONTAINED IN H.R. 5244

RESEARCH AND DEVELOPMENT—FISCAL YEAR 1985

A. FOSSIL ENERGY

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Control technology	26,000	32,150	+2,900	35,050
Advanced research and technology development	39,250	40,267	+2,000	42,267
Coal liquefaction	28,900	13,900	+9,200	23,100
Combustion systems	18,200	31,675	−12,500	19,175
Fuel cells	42,600	13,700	+27,900	41,600
Heat engines	6,500	7,650	+5,000	12,650
Underground coal gasification	6,000	5,850		5,850
MHD	30,000	17,800	+7,000	24,800
Surface coal gasification	36,790	15,000	+6,500	21,500
Subtotal, coal	234,240	177,992	+48,000	225,992
Advanced process technology	5,000	6,200	−700	5,500
Enhanced oil recovery	9,150	13,400	−2,125	11,275
Oil shale	16,150	12,000	+2,000	14,000
Subtotal, petroleum	30,300	31,600	−825	30,775
Enhanced gas recovery	15,500	8,550	+1,000	9,550
Program direction	43,000	45,228	+3,000	48,228
Subtotal, fossil energy operating expenses	323,040	263,370	+51,175	314,545
Capital equipment	1,500	4,500		4,500
Construction	5,040	5,000		5,000
Total program	329,580	272,870	+51,175	324,045

The United States relies upon fossil energy sources—coal, oil and natural gas—for more than ninety percent of its energy requirements. Petroleum and gas make up approximately eleven percent of the proven fossil fuel reserves of the United States, yet they provide about three fourths of the energy consumed from fossil energy resources. As conventional supplies of domestic oil and gas are depleted, the nation will look increasingly to coal as a primary source of energy. Since coal is the largest domestic fossil energy resource and is comparatively underutilized, it is vital that our nation enhance fossil energy research and development efforts to increase our use of coal, as well as to increase the availability of gas and petroleum resources.

Within the Department of Energy, the fossil energy activities are divided into three categories: (1) coal, (2) petroleum, and (3) gas. The Administration's budget proposal for fiscal year 1985 requested $177.99 million for coal research activities, $31.6 million for petroleum research activities, $8.55 million for gas research activities, and $54.73 million for policy and management. The total $272.87 million request for fossil energy R&D represents a 17 percent reduction from the program's fiscal year 1984 appropriated level. The Committee took action to selectively increase those areas where reductions from FY 1984 levels were judged to inhibit the development of fossil alternatives, and recommends levels near those appropriated in fiscal year 1984.

CONTROL TECHNOLOGY AND COAL PREPARATION

Barriers to a rapid, widespread replacement of oil by coal derive mainly from quality differences. Compared to oil and gas, coal is dirty. Additional costs are incurred in burning and transporting most U.S. coals because of the presence of sulfur, or certain mineral constituents or trace elements. The ultimate cost of electricity or process heat is strongly dependent on technologies dealing with coal quality, environmental emissions, and waste disposal. A sound advanced technology base in the interdependent technologies of coal beneficiation, gas cleaning, and waste disposal is essential to economic and engineering analyses for use of coal.

The Committee believes it is essential to upgrade the quality of U.S. coals and develop critical cleanup and control technologies through the proof-of-concept stage to provide an incentive for commercialization by the private sector. The Committee believes industry will not invest in needed long term cleanup R&D since changing regulations can render the resulting technologies obsolete and their investments fruitless, and therefore federal funding is necessary in this area.

The control technology and coal preparation activity includes four subactivities: (1) coal preparation; (2) flue gas cleanup; (3) gas stream cleanup; and (4) cleanup base technology. The Administration's fiscal year 1985 request for the control technology and coal preparation activity totaled $32.15 million.

COMMITTEE ACTION

The Committee increased the administration's request for Control Technology and Preparation operating expenses by $2.9 million for a total of $35.05 million. Within that total, the Committee reduced the flue gas cleanup activity by $2.6 million to a level of $11.425 million. The Administration included a $5.225 million initiative to develop cheap retrofit scrubbers for existing coal installations. The proposed program would be a three year effort. The processes that might be involved are ill-defined, and the ability to develop cheap scrubber technology is currently unclear. The Committee's level of funding reduces the size of the initiative until the quality of the proposals received can be evaluated.

The Committee added $1.5 million to the gas stream cleanup activity to bring it to a level of $6.475 million. The Administration's budget reduces cleanup work for turbine gas streams by almost

$1.5 million below FY 1984. Because of DOE emphasis on pressurized fluidized beds and coal-firing of turbines, as well as the use of gasifiers with turbines, cleanup of these gas streams is essential. The Committee's action returns funding to the FY 1984 level.

A total of $13.15 million is authorized for coal preparation. The increase of $2.0 million is to accelerate work in both chemical and physical coal cleaning to develop products that can replace oil and gas in new and retrofit applications in boilers, heaters, and heat engines of all kinds.

Within the funds provided for the Coal Preparation activity, $1.0 million is provided to support coal research activities at the Carbondale Coal Technology Laboratory subsequent to activities funded through June 30, 1985, and $1.5 million is provided for continuing the coal preparation program at Ames Laboratory. In addition, the Committee expects the Department to make every reasonable effort to use the large coal processing facilities at Ames for the various projects in coal cleaning and preparation requiring large scale equipment.

A total of $4.0 million is authorized for cleanup base technology. The $2.0 million increase is for reseach in management of coal wastes to minimize environmental concerns and enhance energy recovery. Research should focus on reducing waste volumes, changing the composition of the waste to more environmentally benign forms, and increasing hydrocarbon recovery. Within this amount up to $300,000 should be available for treatment of coal fly ash by the Hichlor process.

Finally, within the funds provided for the Control Technology and Coal Preparation activity up to $300,000 is provided for work on the microbubble flotation process for the production of superclean coal, and electrochemical separation processes for coal cleaning. No funds are provided for larger than bench-scale equipment or facilities.

ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT

The Advanced Research and Technology Development (AR&TD) activity plays an important role in the Department's Fossil Energy program through development of the technology base in coal. Basic, applied, and exploratory high risk, potentially high payoff research at the Energy Technology Centers, National Laboratories, universities, and industrial laboratories helps extend the fundamental scientific and engineering knowledge base providing ideas for new process and technical breakthroughs in coal conversion and utilization.

The main objectives of the AR&TD activity are to:

Provide a focal point for government involvement in fundamental research on coal;

Development a better understanding of coal liquefaction and gasification processes, coal chemistry and related process engineering sciences;

Expand the knowledge base on the physical, chemical and thermodynamic properties of fossil fuel liquids;

Expand the data base, understanding, and verified modeling capability covering those chemical and physical phenomena

critical to the design and performance of improved coal combustion systems;

Provide a better understanding of the behavior of materials, components and instrumentation in environments associated with those expected to be found in advanced coal systems;

Explore new materials, catalysts, and electrolytes for fuel cell systems;

Provide assessment and coordination of research and environmental support to Fossil Energy advanced programs;

Coordinate the planning and development of a balanced Fossil Energy program;

Coordinate, assess and plan Fossil Energy advanced research including international and cross-cut activities.

To accomplish these objectives, the activity is divided into five functional areas: (1) processes, (2) direct utilization, (3) materials and components, (4) university coal research, and (5) technology crosscut. The Administration's fiscal year 1985 request for the AR&TD activity totaled $40.27 million.

COMMITTEE ACTION

The Committee increased the Administration's request for Advanced Research and Technology Development operating expenses by $2.0 million for a total of $42.267 million. Within this total, the Committee added $2.0 million to the direct utilization activity to bring it to a level of $12.16 million. In FY 1984, the appropriation set aside $2.0 million in addition to work being done by DOE in-house organizations for R&D work on phosphoric acid fuel cells by private industry. These funds were instrumental in solving pre-operational problems on the first on-site fuel cell systems. This work is different than the large scale engineering and design work done under the fuel cell activity. The Committee recommendation continues this R&D allocation.

The Committee added $2.5 million to the materials and components activity to bring it to a level of $10.557 million. The materials area was reduced in the FY 1985 budget by over $400,000. This area is one of the true "cross-cutting" R&D programs which supports most fossil programs. This is a well-defined program aimed at erosion and corrosion problems in both coal conversion and utilization. The Committee's action redirects $2.5 million from the processes, direct utilization, and technology cross-cut programs in a general reduction.

Within the funds provided for the processes activity up to $1.0 million is provided to examine the chemical and mechanical causes of fines production in gasifiers.

COAL LIQUEFACTION

The goal of the Coal Liquefaction program is to contribute to a generic data base that will facilitate the private sector's production of environmentally acceptable and price competitive synthetic liquid fuels.

Products obtained from coal liquefaction processes can replace petroleum products as boiler fuel for utilities or be refined to transportation fuel, furnace oils, and chemical feedstocks. Coal is, by far,

the largest domestic fossil energy resource available to the U.S. In order to meet the future energy requirements of this country, it will be necessary at some point to use this resource to increase the supply of liquid fuels. With high uncertainty in supplies and prices in the international petroleum market, the private sector will not undertake the long range, high risk R&D required to develop this data base—particularly in the absence of sufficient profit incentives.

The coal liquefaction activity includes three subactivities: (1) indirect liquefaction; (2) advanced process development; and (3) support studies/engineering evaluations. The Administration's fiscal year 1985 request for coal liquefaction totaled $13.9 million.

COMMITTEE ACTION

The Committee increased the Administration's request for Coal Liquefaction operating expenses by $9.2 million for a total of $23.1 million. Within the increase the Committee added $3.65 million for indirect liquefaction to bring it to a level of $6.15 million. Of this increase $2.15 million is to continue operations of the La Porte, TX liquid phase methanol pilot plant through the end of fiscal year 1985, a six month extension. Liquid phase preparation of methanol from coal gasification products would allow simple use of gases from the newer gasifiers. The DOE budget barely allows one year of operations from start-up, and other catalysts and processes would not be able to be tested.

Also included in this increase is $1.5 million to continue industrial catalyst and process development at a reduced level. The fiscal year 1985 budget reduces this work by almost $5.4 million and concentrates on in-house work. It is also important to develop catatylsts for conversion of gases directly to diesel or gasoline fuels in the liquid phase, as well as for methanol conversion.

The Committee added $5.55 million to advanced process development to bring it to a level of $11.15 million. This increase will allow the Wilsonville, AL two-stage liquefaction pilot plant to operate until the end of fiscal year 1985, a nine month extension. The two-stage liquefaction process is an improvement over previous direct liquefaction processes (SRC I and II, H-Coal, EDS). EPRI will provide a 25 percent cost-share for operations. This is the only large scale facility remaining in the program and will allow processing of more difficult coals and solving of process problems at a scale sufficient to allow a commercial plant to be built.

COMBUSTION SYSTEMS

The goal of the combustion systems program is to conduct generic technology base development with potential for high risk and high payoff related to advanced coal and coal-derived fuel combustion concepts. These research efforts are intended to establish the technology base from which industry can develop, demonstrate and commercialize improved systems which can allow for the expanded utilization of coal in an environmentally acceptable manner. The programs involve generic research on atmospheric and pressurized fluidized bed combustion, alternate fuel mixtures, and advanced

combustion technology. For fiscal year 1985, the Administration budget request is $31.675 million.

COMMITTEE ACTION

The Committee decreased the Administration's request for Combustion Systems by $12.5 million for a total of $19.175 million. The Committee subtracted $13.5 million from the atmospheric fluidized beds activity to bring it to a level of $4.0 million. Included in this change is a reduction of $15.0 million for the TVA demonstration plant because funding was previously appropriated. Also included is an increase of $1.5 million for use in facilities which have been built with DOE assistance. Because of inexperience in design of tubes for fluidized bed boilers using coal, extraordinary erosion has occurred in at least one case. Funds would provide assistance for tube replacement in such facilities in exchange for data and analysis of alternate tube designs.

A total of $3.0 million is recommended for advanced combustion technology to accelerate the work on developing advanced combustors to allow the use of coal to replace oil and natural gas in new or retrofit utility or industrial boilers.

FUEL CELLS

Fuel cells are electrochemical conversion systems which are highly efficient, modular, and environmentally benign energy producing systems. They have the ability to produce electricity from a wide spectrum of fuels, including synthetic liquids and gases from coal, biomass and waste. In addition, on-site installations have the potential for meeting the consumer's electrical and thermal requirements, thereby utilizing up to 85 percent of the energy available in the fuel. The Administration has requested $13.7 million for this program in fiscal year 1985.

COMMITTEE ACTION

The Committee increased the Administration's request for Fuel Cells operating expenses by $27.9 million for a total of $41.6 million. The Committee added $22.2 million to the phosphoric acid system activity to bring it to a level of $29.4 million.

The Committee's additions would continue existing cost-shared contracts for both utility and on-site fuel cell power plants. Funds are utilized to test large integrated cell stacks and to develop technology for expected commercial offerings in the next few years.

Program and funding

	Millions
Utility:	
11 megawatt technology development	$6.0
7.5 megawatt technology development	14.0
On-site 40 kilowatt technology development	6.0
Organic-cooled, mobile application	2.0
Base technology	1.4
Total	29.4

The Committee has deferred action on a proposed cost-shared test and evaluation program at the fuel cell experimental facility in New York City. While there is justification for proceeding with

the program, the Committee expects to have initial operating data from the 4.8 Mw experiment and a firm commitment from the private sector to assume a large portion of the total expenses of the program, including all site costs and test and operation expenses, in hand before considering DOE's participation.

The Committee added $5.7 million to the molten carbonate systems activity to bring it to a level of $9.8 million. As in phosphoric acid cells, the Committee's action would continue existing contracts at approximately last year's level. R&D in this area is long range and would not be picked up by industry if reduced.

Program and funding

	Millions
Full area short stack technology	$5.0
Direct fuel cell	2.2
Alternative technology (3rd contractor)	1.5
Technology base	1.1
Total	9.8

HEAT ENGINES

The goal of the heat engines program is to establish technical data which will enable the private sector to assess the commercial viability of coal-fueled power conversion systems. The program is directed towards major technical problems associated with substituting coal or coal-derived liquid or gaseous fuels for distillate fuels or natural gas in firing gas turbine and diesel power conversion systems. The ultimate goal is to develop a technology base which would permit direct firing of a premium quality, fine particulate coal slurried with water and/or a coal-derived liquid such as methanol. The Administration's request for fiscal year 1985 is $7.65 million.

COMMITTEE ACTION

A total of $12.65 million is authorized for heat engines. Within these amounts $1.0 million above the Department's requested level should be allocated to research on coal-fired diesels, and the remaining increase of $4.0 million is for accelerated research on "fuel-flexible" turbines. Work on combustors, components, cleanup systems, and coal based fuel forms should be included in this activity.

Within the funds provided for heat engines up to $500,000 is provided to initiate study of the development of an integrated coal-fired power train for locomotive application that is competitive with current oil diesel systems. The study should examine ongoing base technology programs in coal slurry combustion, heat engines and coal beneficiation and should include both near-term and longer-range, high payoff system concepts and the use of both low and high sulfur coal. The study should result in recommendations to Congress on the further pursuit of coal-fired locomotive applications, and the future government role. A combination of industrial, university, and national laboratory expertise could be applied to this study.

UNDERGROUND COAL GASIFICATION

Underground coal gasification (UCG) is a method of producing fuels by gasifying seams of coal "in-situ," without mining. This can include several related processes for converting coal, underground, to more easily recoverable gaseous fuels which can either be directly utilized or converted to other hydrocarbon products. This process offers the potential of significant energy recovery from coal deposits that are unmineable because of very thick overburdens or steeply dipping beds. The Administration has requested $5.85 million for the UCG program.

COMMITTEE ACTION

No change.

MAGNETOHYDRODYNAMICS

Magnetohydrodynamics (MHD) is a long range technology which offers the potential for electric generation from coal at high overall conversion efficiencies and low environmental impact. In the MHD process, coal is burned to produce extremely high temperature combustion products which become ionized in the form of a plasma. This plasma, when passed through an intense magnetic field will result in a significant DC current flow. Subsequently, these combustion products can be used as the energy source for conventional steam turbine power generation. The goals of the magnetohydrodynamics program are to acquire the scientific data necessary to resolve key technical issues leading to design, construction, and operation of an integrated coal-fired MHD combined cycle system. The Administration has requested $17.8 million for the program in fiscal year 1985.

COMMITTEE VIEWS

The Committee is aware of the beginning of an effort by the Department and the private entities involved in the development of MHD to establish a comprehensive plan for the ultimate commercialization of the technology, including an overall research, development, and demonstration activity. The Committee commends this effort, particularly after years of lack of communication on the desired direction of the program. Should a comprehensive plan be prepared which required additional funds for the government portion of development, the Committee would seriously consider supplemental authorization legislation to provide the needed funds.

The DOE should review the capabilities of facilities, including the Coal-Fired Flow Facility (CFFF), for utilization across the coal research and development program to perform integration testing activities. Such a review should assure that proposed activities at the CFFF and its related facilities are at levels of effort consonant with current year levels.

COMMITTEE ACTION

The recommendation of the Committee deletes the requirement for immediate cost-sharing and provides a total of $24.8 million for fiscal year 1985, an increase of $7.0 million above the request.

SURFACE COAL GASIFICATION

The surface coal gasification program's overall goal is to assist industry in advancing the state-of-the-art of coal gasification through the parallel development of new concepts, the refinement of existing systems and the generation of an adequate technology data base for the private sector to conduct normal risk assessments upon which to base commercialization decisions. This goal is being achieved through the development of advanced gasifiers and gasification processes that have the capability to process all U.S. coals irrespective of the widely differing physical properties and chemical compositions that characterize these heterogeneous feedstocks. These studies are directed specifically at those early stages of process development when the risks are very high and the potential return is as yet uncertain. These efforts include the investigation of processing fundamentals as well as new and promising gasifier and gasification process concepts. In developing these advanced environmentally acceptable processes, the full potential of coal gasification as a means for converting the extensive coal resources into clean alternate fuels can be realized. Through gasification, coal can be used for the economic manufacture of fuel gases having heating values that range from low/medium-Btu fuel gas for industrial and electric utility uses to high-Btu gas of pipeline quality that can be used to supplement supplies of natural gas. Gasification technology also can be used to produce a synthesis gas suitable for subsequent conversion into a variety of liquid fuels or for use as a feedstock for the manufacture of chemicals. For fiscal year 1985 the Administration has requested $15.0 million for the surface coal gasification program.

COMMITTEE ACTION

The Committee increased the Administration's request for Surface Coal Gasification operating expenses by $6.5 million for a total of $21.5 million. The Committee added $6.5 million to the system engineering concepts activity to bring it to a level of $10.475 million. This allows for the continued operation of the Waltz Mill, PA gasifier which utilizes fines and agglomerating eastern coals. This facility can also be used on an integrated basis with gas cleanup systems to test the gasifier's use with turbines. The Gas Research Institute has indicated an interest in cost-sharing in FY 1985, as has the new ownership. A reasonable long range plan for this technology would be to test the gasifier at a larger scale (with private sector/GRI funds) at a facility such as Great Plains.

Also, within the funds provided for Surface Coal Gasification up to $3.0 million is provided for the following research:

—Up to $0.5 million for isotopic labeling of sulfur, nitrogen, and oxygen atoms in coal to better understand and control conversion mechanisms in coal gasification;

—Up to $1.0 million for the study of ash behavior and chemistry in gasification of coal in ash agglomerating gasifiers, including various process efforts on the kinetics and mechanics of agglomeration;
—Up to $1.5 million to continue the development of composite sorbants for removal of contaminants from gasifier effluent streams.

ADVANCED PROCESS TECHNOLOGY

The goal of the advanced process technology program is to identify and develop advanced extraction, processing, and environmental concepts and technology related to oil, gas, tar sands, shale oil and coal liquids. This program includes two subactivities: (1) advanced exploratory research which provides a variety of generic and fundamental supporting research activities (e.g. advanced extraction and advanced utilization research, and research on chemical and physical phenomena underlying processes) crosscutting the petroleum and gas programs; and (2) arctic and offshore research where activities focus on the potential effects of the arctic region on development of well-drilling and production operations.

The Administration's fiscal year 1985 request for advanced process technology totaled $6.2 million.

COMMITTEE ACTION

The Committee decreased the Administration's request for Advanced Process Technology by $0.7 million for a total of $5.5 million. The Committee reduced arctic and offshore trechnology by $0.7 million to bring it to a level of $1.0 million. DOE provides a data gathering, data base management, and coordination function among government agencies involved in arctic and offshore technology activities. The Committee's action of reducing the funding to the FY 1984 level will let this continue. The research the Administration suggested in ice and sea floor characterization is best handled and more completely funded in other agencies (NOAA, USGS, NSF, etc.)

Within the funds for advanced exploratory research $0.4 million is made available for research and development dealing with the production of oil from Devonian shale formations in West Virginia and Ohio. To the extent possible, research should be on wells already drilled, in order to reduce cost.

ENHANCED OIL RECOVERY

The goal of the Enhanced Oil Recovery (EOR) program is to conduct generic technology base R&D activities and to assist industry in obtaining a better understanding of the mechanisms and behavior of advanced and novel EOR processes for heavy oil, light oil, and tar sands. Only one-quarter of the oil discovered to date has been produced. Even the most optimistic projections for future oil recovery estimate that nearly two-thirds of the discovered oil will not be recovered. At present, some of the most advanced, high efficiency EOR methods such as micellar-polymer for light oil and fireflooding for heavy oil/tar sands are not sufficiently understood to

be used with any degree of confidence. Other futuristic approaches such as microbial EOR are only now in a conceptual stage. The EOR porogram supports long range, high risk R&D because the payoffs are too far in the future to attract adequate private venture capital.

The EOR program includes three subactivities: (1) heavy oil; (2) light oil; and (3) tar sands. The Administration's request for EOR totaled $13.4 million.

COMMITTEE ACTION

The Committee decreased the Administration's request for Enhanced Oil Recovery operating expenses by $2.125 million for a total of $11.275 million. An increase of almost 50 percent above FY 1984 levels does not appear to be justified for small scale experimentation. The Committee's action still allows a 23 percent increase, and a growth of almost 75 percent since FY 1983.

OIL SHALE

The oil shale resource in the United States is estimated to be about two trillion barrels of oil equivalent. The richest reserves of oil shale lie in the western states of Colorado, Utah, and Wyoming in areas of high environmental sensitivity. Substantial lower quality resources also occur in the east. The potentially recoverable oil shale resource is much greater than all of the oil reserves of the Middle East. However, none of this resource can yet be classified as reserves in the absence of demonstrated commercial performance of the first generation technologies now being implemented. This resource could easily support shale oil production on the order of millions of barrels per day, thereby contributing substantially to a reduction in imports, if technical, economic, and environmental constraints can be overcome. Research activities in the oil shale program will provide the technology base for a future generation of oil shale processes which will be characterized by reduced environmental impacts and increased resource recovery capability.

The oil shale program includes two subactivities: (1) oil shale technology base; and (2) environmental mitigation. The Administration's request for oil shale totaled $12.0 million.

COMMITTEE ACTION

The Committee increased the Administration's request for Oil Shale by $2.0 million for a total of $14.0 million. The $2.0 million was added to the oil shale technology base activity to bring it to a level of $8.0 million. Technologies for the processing of eastern oil shale have not been as extensively developed as those for western shales. Further process work is necessary to reduce the expense of hydrogen-using technologies by decreasing the amount of hydrogen needed and to improve resource utilization (fines).

UNCONVENTIONAL GAS RECOVERY

Natural gas currently supplies about 25 percent of the total energy consumed in the United States. The annual addition of gas reserves from new discoveries has been less than the withdrawals

from existing reserves for many years. This trend was reversed for one year in 1981, with reserve additions being greater than withdrawals. The change is a result of increased exploration activity resulting from partial decontrol of natural gas prices, and suggests that considerable conventional shallow and deep gas may be available for immediate use. Additional new gas, resulting from successful research on unconventional resources, combined with this conventional gas, represents a secure domestic supply that could meet the nation's needs into the next century, including displacement of imported oil. The Unconventional Gas Recovery program has the goal of assisting the private sector in developing cost-effective diagnostic and extraction technologies to produce gas efficiently and economically from the vast unconventional gas resources. These unconventional sources of gas include the eastern Devonian gas shales, western gas sands, methane from coalbeds, methane hydrates, and deep source gas. The Administration has asked for $8.55 million for this program in fiscal year 1985.

COMMITTEE ACTION

The Committee increased the Administration's request for Unconventional Gas Recovery by $1.0 million for a total of $9.55 million. The Committee added $1.0 million to the eastern gas shales activity to bring it to a level of $2.5 million.

PROGRAM DIRECTION

Program direction provides funds for salaries, benefits and travel for Headquarters staff; for indirect costs at the Energy Technology Centers (ETC's) and the Fossil Energy Project Offices at Bartlesville, Grand Forks, and Laramie; for support of day-to-day project management functions for assigned programmatic areas; for the centralized funding of capital equipment needs in all the Fossil Energy R&D activities conducted at the Energy Technology Centers, the Bartlesville Project office, and the National Laboratories; and for general plant projects (GPP) at the Energy Technology Centers and the Bartlesville Project Office, and one line item construction project. The Administration proposed $7.913 million for Headquarters program direction, $37.315 million for ETC program direction, $4.5 million for capital equipment, and $5.0 million for construction.

COMMITTEE ACTION

The Committee increased the Administration's request for Program Direction operating expenses by $3.0 million for a total of $48.228 million. The Administration testified that to return to personnel levels of previously legislated manpower floors would cost $3.8 million. The Committee's action assumes that some economies can be made in other operating expenses in program direction, while allowing for return to personnel levels consistent with current programs and existing legislation.

GENERAL

COMMITTEE VIEW

The Committee encourages the Department of Energy to increase efforts to develop the technology necessary to utilize the large reserves of Illinois Basin and Southeastern high sulfur coal. In this research, development should be pursued through the pilot plant stage, rather than just the bench-scale level, thus making it more likely that private industry will be able to commercialize available processes.

COMMITTEE ACTION

The Committee recommends that environmental, health and safety R&D, and "lessons learned" activity related to synthetic fuels technology currently underway at Oak Ridge National Laboratory (ORNL) be continued in fiscal year 1985. These activities are currently funded by the Synthetic Fuels Corporation (SFC) and should continue to be so. However, if SFC funding is discontinued, up to $2.0 million should be provided out of fossil energy funds to continue this important work.

The Committee directs the Department to prepare a five year national coal science, technology, and engineering development research plan. Such plan shall include:

(1) An identification and definition of the near and midterm opportunities for expanding, in an environmentally acceptable manner, the use of coal in the industrial, electric utility, and other sectors of the economy;

(2) A detailed description of the specific activities that have been, or will be, developed by the Department of Energy to address such opportunities;

(3) A statement and explanation of specific priorities and objectives, timetables for achieving such objectives, and a research strategy for achieving such objectives; and

(4) A detailed description of the resource requirements for the implementation of such plan, and a description of the manner in which such resources will be deployed.

The Department shall submit the plan to the Committee by October 1, 1984.

B. Energy Conservation

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Buildings and community systems	34,008	24,704	+7,400	32,104
Industrial energy conservation	31,812	29,794	+600	30,394
Multisector	12,277	26,548	−6,150	20,398
Transportation	64,538	49,352	+17,500	66,852
Total program	142,635	130,398	+19,350	149,748

Energy Conservation R&D activities funded in the Committee's recommendation include basic and applied research on energy use in buildings, research and development on energy efficient equipment for buildings and community systems, development and testing of new techniques to recapture waste heat and improve process efficiency in industry; advanced research on fundamental processes and materials (combustion, tribology, materials); and research and development on new automotive vehicle and engine concepts.

COMMITTEE ACTION

The Committee added $19.35 million to the DOE request of $130.398 million in Conservation R&D programs, for a total of $149.748 million. The bulk of this addition was a $17.5 million increase in the transportation program to continue development work on the MOD II Stirling engine. An additional $4.0 million was re-directed within the transportation program from the High Temperature Materials Laboratory to the gas turbine and electric vehicles subprograms. The Committee cut $6.15 million from the Energy Conservation Technology (ECUT) program, $1.1 million from capital equipment for Buildings and Community Systems (BCS), and $4.4 million from capital equipment for the Industrial Energy Conservation program. It added $8.5 million to BCS for building systems, community systems, and building equipment; and $5.0 million to the Industrial program for waste energy reduction, industrial process efficiency, and cogeneration.

BUILDINGS AND COMMUNITY SYSTEMS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Building systems	13,900	12,200	+2,000	14,200
Community systems	4,200	2,000	+1,500	3,500
Urban waste	1,500	0	0	0
Building equipment	10,000	4,900	+5,000	9,900
Program direction	2,908	3,104	0	3,104
Subtotal, operating expenses	32,508	22,204	+8,500	30,704
Capital equipment	1,500	2,500	−1,100	1,400
Total program	34,008	24,704	+7,400	32,104

The Buildings and Community System R&D program consists of three main subprograms.

Building systems.—Basic and applied research on energy characteristics of building components and materials and of whole buildings as systems. This subprogram includes whole building performance research related to the development of voluntary guidelines and rating systems and research utilization activities.

Community systems.—Research and technical assistance to communities on the development of community scale systems to improve energy efficiency and utilize waste energy.

Building equipment.—Research and development on appliances and heating systems of improved efficiency, including heat pumps, combustion equipment, refrigeration systems and lighting systems.

COMMITTEE ACTION

The Committee added $7.4 million to the buildings and community systems R&D request of $24.704 million to bring it to a total of $32.104 million. This is $1.9 million less than the level at which this program was funded in fiscal year 1984.

Building systems.—The Committee added $1.5 million for building systems interactions and $0.5 million for indoor air quality to bring this subprogram to a total of $14.2 million. DOE requested no funds for building systems interactions, which is the primary research activity related to whole building performance, an area which is strongly supported by the building industry. The Committee returned this activity to its fiscal year 1984 level. The DOE request in indoor air quality ($1.425 million) included research on ventilation and infiltration, which were formerly funded as separate activities. The Committee action brings the total for the three activities to a level consistent with DOE multiyear program plans recommendations.

Community systems.—The Committee cut $0.5 million from integrated community systems and added $2.0 million for the urban consortium, to bring this subprogram to a level of $3.5 million.

DOE proposed $2.0 million for a group of community systems R&D programs which did not appear well founded. The Committee recommends reducing the budget for these items to $1.5 million and focusing it on district heating and cooling and technical assistance to communities for energy planning, two areas of well-established need.

The Committee instructs the Department of Energy to prepare a five year plan for community systems research and development, to be submitted to the Committee no later than October 1, 1984. The plan should be developed with extensive involvement by state and local government and industry trade association groups. It should include as a minimum research and technical assistance related to district heating and cooling and community energy planning.

The Committee has reviewed the scope of projects conducted to date by the Urban Consortium Energy Task Force member jurisdictions. While many projects in this program show considerable merit, the Committee believes that those projects which only utilize existing and proven technology should not be supported unless other objectives of the Task Force are thereby enhanced. The Committee encourages DOE to integrate the Urban Consortium Energy Task Force program into its overall community systems program and into the comprehensive multiyear plan for this activity that is to be prepared for the Committee.

Building equipment.—The Committee added $5.0 million to this subprogram to bring it close to its fiscal year 1984 funding level ($9.9 million). The increase consisted of the following elements:

(1) $2.5 million for refrigeration systems. DOE proposed to terminate worthwhile ongoing projects in ground-coupled heat pumps, non-azeotropic working fluids, innovative thermodynamic cycles, and advanced appliance insulation. This increase restores those activities to close to their fiscal year 1984 levels.

(2) $1.5 million for combustion equipment. DOE proposed to terminate research on oil, gas, wood, and coal-fired combustion equipment. Program officials indicate that a good deal of work still needs to be done on corrosion effects, heat exchangers, characterization of radiant heating devices, and advanced atomizers. These activities are recommended by the Committee.

(3) $1.0 million for thermally activated heat pumps. Several witnesses at the fiscal year 1985 DOE Authorization hearings expressed the opinion that more work is needed in this area. The $1.0 million increase allows more R&D to be done on both the Stirling engine and the absorption cycle R&D projects co-funded with industry.

Capital equipment.—The Committee cut $1.1 million from the DOE request, to provide a total of $1.4 million in capital equipment. The Committee believes that many of the smaller items included in the DOE request in this area could be purchased from operating funds without a severe problem for the program.

INDUSTRIAL ENERGY CONSERVATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Waste energy reduction	12,000	12,350	+1,000	13,350
Process efficiency	14,200	8,000	+2,000	10,000
Cogeneration	4,000	3,200	+2,000	5,200
Program direction	1,612	1,844	0	1,844
Subtotal, operating expenses	31,812	25,394	+5,000	30,394
Capital equipment	0	4,400	−4,400	0
Total program	31,812	29,794	+600	30,394

The Industrial Energy Conservation program carries out long-term, high risk research and development aimed at improving the efficiency of industrial and agricultural processes and substituting abundant resources for scarce ones in those sectors. The R&D program consists of three subprograms.

Waste energy reduction.—Development of technologies to recover or recuperate waste heat and materials from industrial processes for use as energy sources.

Industrial process efficiency.—Applied research and development aimed at improving the energy efficiency of equipment used in those most energy-intensive industries which do not carry out a great deal of their own research.

Industrial cogeneration.—Research and development on advanced technologies to generate electric power and thermal energy at industrial sites with a high electricity to steam ratio.

COMMITTEE ACTION

The Committee cut $4.4 million from capital equipment and added $5.0 million for waste energy reduction ($1.0 million), process efficiency ($2.0 million), and cogeneration ($2.0 million). This amounted to a net increase of $0.6 million to the DOE request of $29.794 million for a total authorization of $30.394 million.

Waste energy reduction.—The Committee added $1.0 million for utilization of recycled materials and program support. The DOE request eliminated all support for research aimed at utilizing discarded waste materials such as roofing asphalt, paper and waste hydrocarbons (funded at $500,000 in fiscal year 1984). It also eliminated funding for program support ($1.17 million in fiscal year 1984), which produced a number of analyses of use to the Committee (such as the review of international industrial conservation R&D) and the valuable industrial program summaries. This recommendation would restore a modest amount of funding in these two areas.

Process efficiency.—The Committee added $2.0 million to this subprogram, consisting of the following two initiatives.

1. $1.0 million for sensors and controls, and separation technology. The DOE fiscal year 1985 request would terminate a number of ongoing activities in these two areas which have not reached a logical conclusion. Projects include development of an elevated temperature anti-fouling humidity sensor for industrial applications; development of a solid polymer electrolytic hygrometer for humidity measurement and control in dryer hoods; development of an automatic sensing control system for soil nitrogen fertilizers; and testing of membrane materials and designs for different separation applications. The Committee recommendation would provide a modest amount of funding for DOE to continue research in the highest priority areas, as determined by the program managers.

2. $1.0 million for direct thin strip casting R&D. At the authorization hearing on February 29 witnesses testified that DOE should pursue R&D on the two most promising thin strip casting concepts; the twin belt process and the single roller process. The thin strip pilot plant project, initiated in fiscal year 1984, will help develop one of these two processes. The $1.0 million increase will fund the first year of a more modest R&D program in support of the thin strip casting process not selected for the pilot plant.

Cogeneration.—The Committee added $2.0 million for coal-fired Brayton topping cycle systems, R&D on thermionic burners, and advanced organic rankine cycle fluids for bottoming cycle applications. The DOE request does not provide sufficient funds to fabricate and operate the test stand for the coal-fired Brayton cycle combustor system. Funds would be provided for that activity. The transfer of the thermionic burner R&D program from fossil to nuclear energy effectively terminated this activity, since the nuclear thermionic system involves a completely different technology. The industrial program request for fiscal year 1985 only funds an industrial test without any supporting R&D. The Committee recommendation provides funds to continue the R&D program previously carried out under fossil energy, at a modest level. The DOE fiscal year 1985 request also provides no funds to continue R&D on advanced organic rankine cycle working fluids, vaporizers and systems concepts for bottoming cycle applications. The increase would provide modest funding for research on these items.

Capital equipment.—The Committee cut $4.4 million, because it does not believe that the DOE request for $4.4 million in capital equipment is justified. The industrial program does not conduct a great deal of in-house research at the national laboratories. Rather, it uses the laboratory staff primarily for technical management of industrial contracts. Therefore, it is neither necessary nor desirable to build up a capital equipment inventory in the national laboratories for this program.

MULTI-SECTOR

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 Budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Inventors program	3,000	5,000	0	5,000
Energy conversion technology	9,000	17,850	−4,000	13,850
Program direction	277	298	0	298
Subtotal, operating expenses	12,277	23,148	−4,000	19,148
Capital equipment	0	3,400	−2,150	1,250
Total, multisector program	12,277	26,548	−6,150	20,398

The Conservation Multi-Sector category is comprised of two separate research and development programs: energy related inventions and energy conversion technology.

Energy related inventions program (ERIP).—ERIP provides direct support to inventors by evaluating their inventions, providing technical assistance, and supporting the development and demonstration of those products that receive a favorable evaluation. The National Bureau of Standards carries out the evaluations and DOE negotiates support contracts with successful inventors. As of January, 1984 more than 21,000 evaluation requests had been received by NBS, more than 10,000 had been accepted for evaluation, 246 had been recommended to DOE for support, and 165 support awards had been negotiated. Thirty five of the supported inventions had entered the market, with total sales of $178 million.

Energy conversion technology.—This program supports basic and applied research on advanced concepts for improved energy efficiency in areas such as combustion, thermal sciences, materials, catalysis, and tribology.

COMMITTEE ACTION

The Committee reduced funding for this program area by $6.15 million, reducing the proposed growth of the ECUT program by about 50 percent.

Energy conversion technology (ECUT).—The Committee cut $4.0 million in operating expenses and $2.15 million in capital equipment, to bring the total ECUT budget for FY 1985 to $15.1 million ($13.85 million in operating expenses and $1.25 million in capital equipment). DOE proposed to increase the budget for material sciences, catalysis and biocatalysis, tribology, and innovation from a total of $4.136 million in FY 1984 to $12.0 million in FY 1985, a 190 percent increase. The Committee strongly supports increased funding for ECUT, but does not believe that such a rapid increase is either necessary or prudent for these subprograms. The Committee reduced total funding for the four subprograms above to $8.0 million, which still represents a 93 percent increase over FY 1984 levels. DOE should apportion the cuts where they would have the

least effect. DOE also proposed to add $3.4 million for capital equipment in the ECUT program. Committee review of this request indicates that much of it could be postponed or absorbed within the operating budgets of the subprograms. Therefore, the Committee cut this request by $2.15 million. The Committee does not recommend funds for the phase zero design study for an ECUT research facility. The Committee notes that the ECUT program has access to two of the best new laboratories in the DOE system: the combustion research test facility at Sandia Livermore and the high temperature materials laboratory at ORNL, which will be completed in 1988. Since these two facilities support ECUT's two largest subprograms it is not clear what would be gained by adding a third facility.

TRANSPORTATION

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Vehicle propulsion R&D	38,100	18,500	+20,000	38,500
Electric/hybrid vehicle R&D	11,700	6,800	+1,500	8,300
Alternate fuels utilization	2,600	1,500	0	1,500
Advanced materials development	1,500	7,000	0	7,000
Program direction	1,638	1,952	0	1,952
Subtotal	55,538	35,752	+21,500	57,252
Capital equipment	0	3,000	0	3,000
Construction: Advanced materials development	9,000	10,600	−4,000	6,600
Total program	64,538	49,352	+17,500	66,852

The objective of the transportation program is to perform research and development on vehicles and engines which will increase the fuel efficiency of the transportation system and allow a switch from petroleum to electricity and alternative fuels. The strategy to achieve this objective includes emphasis on technology development rather than product design, maximum involvement by U.S. industry in indentification and solution of technology problems, and concentration on key technology barriers where risks prohibit industry-only financing.

Vehicle Propulsion R&D

The transportation sector accounts for 27 percent of energy use in the United States, and 61 percent of pertroleum use. Highway vehicles use over 76 percent of transportation energy, with automobiles alone accounting for nearly half the transportation energy use at the present time. However, by the year 2000 energy use by trucks is expected to be as large as that for automobiles. The goal of the Vehicle Propulsion R&D program area is to provide the automotive industry with proof-of-concepts for advanced heat engine technology that will result in at least a 30 percent improvement in fuel efficiency, the capability to meet emissions, safety and noise standards, and the capability to use alternative fuels.

The Vehicle Propulsion R&D program was formulated in response to the Automotive Propulsion Research and Development Act of 1978 (Title III of P.L. 95–238) and has focussed on development of advanced automotive gas turbine and Stirling engines for light duty vehicles, and the uncooled, minimum friction diesel engine with integrated waste heat recovery (adiabatic diesel) for the heavy duty transport sector. Although included as a separate budget item, the Advanced Materials Program directly supports these engine projects in the development of critical high temperature ceramic materials.

Major implementation of the Automotive Gas Turbine (AGT) project has occurred through cost-shared, proof-of-concept engine development contracts with two industry teams: a single-shaft configuration (AGT 101) being developed by Garrett Corporation/Ford Motor Company and a two-shaft concept by Allison Gas Turbine Operations/Pontiac Motor Division of General Motors. Application of high-temperature structural ceramic components is a key technology barrier in both concepts because of the high operating temperatures necessary to achieve efficiency goals. Advanced ceramic components are integrated into subsequent builds of the test engines, with proof-of-concept achieved in the FY 1985–FY 1986 time frame with dynamometer performance characterization of a fully ceramized high temperature configuration. During FY 1984 both contractor teams will complete performance testing of their engine designs in a basic metal configuration (limited stationary ceramic components) and will accomplish qualification tests of developed ceramic components. In FY 1985, the proof-of-concept engine development activity will be continued with both contractor teams continuing to integrate qualified ceramic components until final configuration is reached and characterized.

The Automotive Stirling Engine (ASE) project has been centered on a proof-of-concept engine development contract with an industry team led by Mechanical Technology Incorporated (MTI) combined with United Stirling AB of Sweden. Under the program, transfer of Stirling technology to the United States has been accomplished. Over 4000 hours of performance testing has been completed on 5 MOD I experimental engines, and predicted performance goals for the design confirmed, including a maximum efficiency of 37 percent. An Industry Evaluation phase has been initiated where MOD I engines will be loaned to the automotive industry for independent evaluation. During FY 1984, the Upgraded MOD I engine, which operates at higher temperatures and utilizes improved metal components, will be fully tested, and advanced component development will be integrated into the reference engine design (MOD II) for industry use. The Industry Evaluation will also be completed during FY 1984. In FY 1985 the final detailed design of MOD II will be completed, technology development and component development will be continued, and all needed engine hardware procured.

The Heavy Duty Transport Technology project has focused on establishing a technology data base for industry development of uncooled, minimum friction, (adiabatic) diesel engines. Elimination of the cooling system, with attendant higher operating temperatures and recovery of the increased exhaust heat, offers the potential for greatly improved operational fuel economy. The project strategy

has been to concentrate on technology barriers identified by industry, and to design project implementation to allow a phased introduction by industry of individual components and concepts. During FY 1984 first phase efforts on a series of feasibility contracts involving thermal barrier coatings, structural ceramic components, ceramics joining, high temperature tribology, and advanced waste heat utilization concepts will be completed and screened. In FY 1985, the component development stage will be continued on promising ceramic components and coatings, solid lubricants and gas bearings, and system integration with implementation of single-cylinder test and evaluation capability. Efforts in combustion and tribology research sponsored by the Energy Conversion Technology (ECUT) Program in the Office of Energy Systems Research complement and are coordinated with these activities.

Technology Assessment and Transfer activities will be continued in FY 1985 to provide an ongoing assessment of related developments by industry and other Government sponsored programs and to assure that maximum interface is accomplished with industry both for dissemination of program results and inputs on technology needs.

Electric and Hybrid Vehicle R&D

Automobiles and light trucks use 65% of the petroleum used in the transportation sector. The goal of the Electric and Hybrid Vehicle Program is to provide the technology for use by the private sector to produce petroleum free or near-petroleum-free vehicles to substitute for automobiles and light trucks.

The Electric and Hybrid Vehicle Program was established and is being carried out in response to the Electric Vehicle Research, Development and Demonstration Act of 1976 (P.L. 94–413) as revised by Title VI, P.L. 95–238. The focus of the program is to conduct the R&D necessary to advance the technology to the point that transfer to the automobile industry for application-oriented R&D becomes feasible.

Electric vehicle research and development has focused on development of experimental batteries and propulsion system technology for passenger car and commercial van or truck application.

Advanced lead-acid activity is developing new lead-plastic composite grids and flow through electrolyte systems. Nickel-iron activity is developing electrolyte and, thermal control systems as well as the technology for longer life and lower cost systems. In FY 1985, the technology development of these batteries will continue. Zinc-bromine, tubular plate lead-acid and sodium-sulfur batteries are being investigated for integration with the advanced a.c. powertrain technology under development by the Ford Motor Company in a cost-shared contract with DOE. In FY 1985, the development of the a.c. powertrain and battery system technology will be continued that will lead to an integrated proof-of-concept propulsion system for passenger car application. In FY 1985, the program to further advance sodium-sulfur technology will continue with emphasis on determining the optimum cell configurations, thermal management and packaging for the electric vehicle application. In FY 1984 the development of an advanced a.c. propulsion system for potential van or light truck application was initiated based on a

powertrain system developed by Eaton and a nickel-iron battery system by Eagle-Picher. In FY 1985, the advanced propulsion system development will be continued culminating in an integrated proof-of-concept system.

Hybrid vehicle technology development will be completed in FY 1985 using prior year's funds. This activity includes the experimental evaluation and tradeoff studies of the most promising battery systems for the hybrid application, computer simulation and analysis of advanced conceptual designs, and the requirements analysis of components and subsystems of propulsion systems.

Advanced vehicle technology is investigating potentially promising battery and fuel cell systems that could be applied to vehicle propulsion. The development of the technology of advanced batteries such as aluminum-air and fuel cells is supported by funds appropriated in Public Law 98–50. In FY 1985, vehicle application studies will be conducted of potentially promising advanced systems to determine the viability of the technology for an unlimited range full performance electric and hybrid vehicle. Fellowships at the national Government laboratories where this work is being carried out will be established for university or private industry candidates so that an effective transfer of the technology can occur and to involve the expertise of university and industry specialists to contribute to the development process. The test and evaluation activities include the data collection and analysis of actual on-the-road electric vehicles to determine the viability of improved technologies. As contracts expire, the number of active test sites is being reduced. Some vehicles from inactive sites are being transferred to other active sites and others are being retired.

In FY 1985, the program will continue to collect and refine the data base to provide information to the R&D community and elimnate vehicle deficiencies. Site Operator Workshops are being conducted to exchange data and problem solving techniques. The Site Operators' User Task Force has been integrating new technologies such as nickel-iron batteries, controllers and state-of-charge indicators into vehicles for proof-of-concept testing. In FY 1985, a second round of improved components including transmissions and a microprocessor controlled battery management system is planned for vehicle integration and testing. Laboratory testing and evaluation of experimental batteries and propulsion systems is being conducted using test bed vehicles on controlled dynamometers at the Jet Propulsion Laboratory. In FY 1984, the in-vehicle dynamometer testing is being transferred to the Idaho National Engineering Laboratory. In FY 1984, the laboratory and in-vehicle dynamometer testing will continue on zinc-chlorine battery systems, nickel-iron battery systems, a.c. propulsion system and an advanced d.c. controller. Life durability and charging regimes testing of experimental batteries such as gel cell lead-acid and nickel-iron are being carried out in laboratory conditions and a small test fleet. In FY 1985, the life and charging regime testing will continue, and the small test fleet activity will be completed. Technical support to the site operators is being provided in FY 1984 and FY 1985 to assist in analyzing and solving operational problems and to conduct maintenance and repair workshops. The development of a microprocessor battery charger/state-of-charge indicator system will be completed

in FY 1984 and will be integrated into vehicles in FY 1984 for field tests at selected sites. Flame arrestors will also be installed and tested.

Alternative Fuels Utilization

The goal of the Alternative Fuels Utilization Program is to encourage the use of nonpetroleum based fuels in the transportation sector by establishing a utilization oriented data base for alternative fuels in both contemporary and advanced heat engines. The approach has been to conduct systematic investigations of the fundamentals of alternative fuel use problems in both spark ignition and diesel engines, concentrating on nearer-term fuels first (alcohols) and expanding the data base in subsequent stages to include synthetic fuels and advanced engines.

During FY 1984 the utilization data base for alcohol fuels will essentially be completed, and a capability for producing standard synthetic test fuels will become available for industry and scientific investigators. In FY 1985, basic fuel/engine performance/emissions investigations will be conducted to identify and provide an understanding of engine problems associated with the use of synthetic fuels, and the alternative fuels utilization data base expended to include the results of the investigations. Work will be continued on methane utilization with primary emphasis on diesel engine data. Methodology development for evaluation of alternative fuels in uncooled, high temperature, engine environments will be initiated.

Advanced Materials Development

In almost all high performance energy conversion systems, and in particular in advanced transportation engines, operations at high temperatures in corrosive environments is a key requirement for obtaining substantially improved efficiencies. A critical need is the development of ceramic or ceramic composite components which can withstand these operational characteristics. Although the advanced engine projects are providing the required focus to prove the feasibility of ceramic components, they have also demonstrated that a parallel basic ceramics research effort is necessary for future development of reliable and reproducible ceramic parts. The goal of the Advanced Materials Development program is to establish an industrial technology base in ceramics and ceramic composites through research in the fundamental areas of ceramic materials and processing, design methodology, and data base/life prediction.

Activities to date and through fiscal year 1984 have resulted in the development of a long-range research plan based on a comprehensive assessment of industry requirements, the establishment of a common technical agenda with other Government agencies and laboratories, the organization of a formal interagency/industry coordinating committee to review research efforts and results, and the initiation of specific research efforts identified in the plan including time-temperature ceramic properties evaluation, transformation-toughened ceramics characterization, fiber-reinforced ceramic composites and ceramic coatings. In fiscal year 1985 research activities will be expanded to include development of improved powders, high temperature property determination of ceramic com-

posites, ceramic/ceramic joining, non-destructive evaluation of green-state ceramics, statistical concepts for design methodology, three dimensional modeling, and processing, characterization, and densification of green-state ceramics. Continuing interface will be maintained with both government and industry laboratories, and industry/university fellowships will be instituted to strengthen feedback and maximize technology transfer. The advanced heat engine projects will continue to serve as industry test and evaluation sources.

Program direction

The budget request provides for 29 FTE to develop the overall strategies, plans and resource requirements, and provide the integrated program management necessary to conduct the research and development of the various transportation technologies described.

Capital equipment

Unique laboratory equipment will be needed to support the research activities currently underway. In fiscal year 1985, the Advanced Materials Development program is planning to procure a ceramic injection molding unit, high temperature crack growth test instrumentation and a ceramic materials hot isostatic press. This equipment will be installed in the High Temperature Materials Laboratory when completed. The Electric Vehicle program is moving the laboratory testing activity from the Jet Propulsion Laboratory to the Idaho National Engineering Laboratory (INEL). Automated cycling equipment to simulate driving conditions on the dynamometer and vehicle test instrumentation will be required to upgrade the testing capability at INEL.

Construction

To support the advanced high temperature materials efforts both within government and in industry, construction of a High Temperature Materials Laboratory (HTML) at Oak Ridge National Laboratory was initiated in fiscal year 1983. The HTML will provide a unique capability for high temperature materials research which (1) makes available a broad multidisciplinary professional staff, (2) provides a common focal point for industrial/university/government participation, and (3) provides access to high-cost research equipment which would otherwise be denied many researchers. During fiscal year 1984 the architectural and engineering designs for the laboratory will be completed. In fiscal year 1985 the construction contract will be finalized, and site preparation, foundations and major items of research equipment will be prepared. Building occupancy is scheduled for 1988.

COMMITTEE VIEWS

National ceramics program

Testimony by a number of academic and industry witnesses has pointed to the need for a national program in advanced structural ceramics. DOE and NASA have made significant efforts to coordinate their advanced ceramic programs. However, the Committee

feels further efforts should be undertaken to establish goals and priorities for a national ceramic program that goes beyond that now being contemplated. Integration of the NASA and DOE programs with other agency activities in structural ceramics would certainly appear in order. Responsibility setting for various components of such a national program is also necessary. Finally, more direct, high-level policy involvement through OSTP, a Cabinet Council or some other mechanism (such as currently proposed in H.R. 4186/S. 373) together with close involvement of the private sector is highly recommended.

Export control of advanced composite materials

Circulation of draft "Guidelines for International Trade in Composite Materials" by the Department of Defense has raised a number of concerns which could have long-term and long-lasting effects on advanced materials research programs now underway in DOE, NASA, NSF and elsewhere. Whereas the stated goal of the guidelines is to "safeguard U.S. technological developments with military utility in this area while allowing commercial and governmental exchanges with other nations", both industry and academic experts fear all composites research and information exchanges will be severely hampered. From the perspective of industry, such curtailment will prevent or severely encumber their ability to compete in the international marketplace where these materials have broad commercial applications. In addition, although the guidelines state "basic scientific data. . . is considered appropriate for open exchange", from a pragmatic view, it will prove extremely difficult to distinguish between "basic" vs "applied" information or research.

In view of these concerns, the Committee feels strongly that implementation of these regulations be delayed until complete evaluation by the appropriate Congressional Committees has occurred. Further, the Committee requests that DOE and NASA evaluate together with DOD the long-term effect of such regulations on the effectiveness of their ongoing and/or proposed advanced composite materials programs.

COMMITTEE ACTION

The Department of Energy requested $49,352,000 for Vehicle and Engine R&D in Fiscal Year 1985. This amount is 24 percent less than the amount appropriated for Fiscal Year 1984.

The Committee understands that the gas turbine program plan has always called for convergence to one contractor. Nevertheless, because of the extremely high level of interest by industry in the ceramics work that is at the core of this project and the different technical approaches being taken, the Committee believes both contractors should be continued through completion of full engine characterization. The Committee therefore recommends an additional $2,500,000 for this purpose, with the expectation that any funding shortfall be made up by additional contractor cost sharing.

Despite Congressional intention to continue the Stirling engine proof-of-concept demonstration, as indicated both in recent authorizations and appropriations, the DOE has again proposed termina-

tion of the project. The Committee believes this action is shortsighted. Accordingly, it recommends $17,500,000 for continuation of the Stirling project toward development and characterization of MOD II.

The Department proposed ending technology development of lead-acid and nickel-iron batteries. The Committee, however, believes this action is premature and that advances in battery capability are key to the eventual success of electric vehicles. Accordingly, the Committee recommends an increase of $1,500,000 to continue this effort.

The Committee finds the total estimated cost of constructing the High Temperature Materials Lab to be excessive for the size and type of building proposed. Of the $10,600,000 requested by DOE, the Committee recommends approval of $6,600,000 in FY 85, $2,700,000 in FY 86 and a reduction of $1,300,000. The total authorization for FY 85 is $66,852,000.

C. Energy Supply R&D

1. SOLAR ENERGY

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Photovoltaic energy systems	48,900	46,500	+5,000	51,500
Solar thermal energy systems	43,600	37,000	+7,000	44,000
Solar building energy research	16,450	11,685	+6,900	18,085
Wind energy systems	26,500	23,100	−5,500	17,600
Biofuels energy systems	28,400	27,100	+5,100	32,200
Ocean energy systems	5,500	3,500	+2,500	6,000
Solar program support	800	500	0	500
Solar resource assessment	0	0	+2,200	2,200
Program direction	6,000	4,864	+136	5,000
Subtotal, operating expenses	176,150	154,249	+22,836	177,085
Capital equipment	250	2,900	0	2,900
Construction	1,500	0	+10,500	10,500
Total program	177,900	157,149	+33,336	190,485

SOLAR ENERGY, CONSTRUCTION

[In thousands of dollars]

Project number	Description	Estimated total cost	Previous appropriations	Fiscal year 1985 DOE request	Authorization
84-CE-001	Phase III Sacramento Municipal Utility District Photovoltaics Plant, 5Mw.	20,000	1,500	0	9,500
85-CE-001	SERI Phase B laboratory facility	25,000	0	0	1,000

The DOE Solar Energy Research and Development program carries out basic and applied research and exploratory and technology development aimed at reducing the cost, improving the performance, and expanding the technology and knowledge base of solar energy sytems.

COMMITTEE ACTION

The Committee authorized a solar budget of $190.5 million for R&D programs, which is $33.3 million above the DOE FY 1985 re-

quest, $12.6 million above the FY 1984 appropriation, and $8.4 million below the FY 1984 authorization. The Committee increase to the DOE request consists of the following major initiatives:

(1) Photovoltaics.—$14.5 million added for the Sacramento Municipal Utility District (SMUD) project and systems research.

(2) Solar thermal.—$7.0 million added for component R&D for molten salt and liquid sodium central receiver technologies.

(3) Solar buildings.—$6.4 million added for passive systems and active components research.

(4) Wind.—$6.5 million cut from aerodynamics and structural research; $1.0 million added for cost-shared R&D.

(5) Biofuels.—$5.1 million added for technology transfer, urban waste and alcohol fuels.

(6) Ocean energy.—$2.5 million added for thermodynamic research and completion of the OTEC test facility.

(7) SERI facility.—$1.0 million added to design a new laboratory building.

(8) Solar resource assessment.—$2.2 million added, and a new line item created for this activity.

(9) Program direction.—$0.136 million added.

PHOTOVOLTAIC ENERGY SYSTEMS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Materials research	26,000	31,000	−1,500	29,500
Collector research	9,300	10,500	0	10,500
Systems research	13,600	5,000	+6,500	11,500
Subtotal, operating expenses	48,900	46,500	+5,000	51,500
Capital equipment	0	1,000	0	1,000
Construction	1,500	0	+9,500	9,500
Total program	50,400	47,500	+14,500	62,000

Photovoltaic devices use thin films or wafers of semiconducting material to convert sunlight directly into electricity with no moving parts. The principal objective of research and development in photovoltaics is to reduce the cost or improve the performance of photovoltaic systems which currently sell for about $10 per peak watt (50–60¢/Kwh).

The DOE photovoltaics program contains three activities.

Materials research.—Investigation and characterization of new and innovative, high performance, low cost materials and concepts.

Collector research.—Development of new techniques for converting photovoltaic materials into cells and modules at substantially lower costs and higher efficiencies. Research and development on concentrating photovoltaics collectors.

Systems research.—Research, testing, and failure analysis on module reliability and performance. Determining systems requirements for cost-effective photovoltaics technology. Carrying out needed research and development on arrays and balance of systems. Collecting and analyzing data from field tests of user oriented systems. Operation of residential experiment stations.

COMMITTEE ACTION

The Committee added $14.5 million to this program, to bring it to a total funding level of $62 million. The Committee changes follow:

Materials research.—$1.5 million reduction. DOE proposed to increase the budget for research on high efficiency concepts from $4.7 million in FY 1984 to $10 million in FY 1985. An increase in this subprogram is well justified, given the progress that has been made recently in gallium arsenide and multijunction cells. However, the $1.0 million cut recommended by the Committee, still leaves a 91 percent increase in the program. The DOE materials research request also contains funds for the SERI solar resource assessment research program, which appears as a separate line item in the Committee authorization. $0.5 million is cut to reflect that change.

The Committee intends that the $1.0 million cut from the DOE FY 1985 request for photovoltaics research shall not in any way affect research on III/V semiconductor compounds such as gallium arsenide. The Committee agrees with the recommendation of the December, 1983 DOE Study, "Photovoltaic Cell Research Priorities," which found the need for more materials research emphasis on III/V semiconductor compounds. Within the funds authorized, DOE is encouraged to expand its research effort on these compounds, with special emphasis on concepts which show potential for low cost, high volume production of high efficiency photovoltaic cells.

Systems research.—Increase of $6.5 million ($11.5 million total). The DOE request for systems research did not contain sufficient funds for module testing at JPL, which is strongly supported by the photovoltaics industry. It also contained no funds for array and balance of systems research or for operation and data collection at the three residential experiment stations and other existing systems experiments. The Committee added $1.5 million for module testing, $3 million for array and balance of systems R&D, and $2.0 million to operate the residential experiment stations.

SMUD phase III.—$9.5 million increase. SMUD proposes to build a 5 Mw (AC) phase III increment of its proposed 100 Mw photovoltaics powerplant for $40 million in FY 1985 and FY 1986. Half of that ($20 million) is to be funded by DOE, of which $1.5 million was obligated in FY 1984. The Committee authorized roughly half, or $9.5 million, of the remaining DOE funds in FY 1985, with $9 million authorized in FY 1986. SMUD also proposes to contract for long lead procurement of 20 Mw (AC) of PV modules for phase IV at the same time, using its own funds.

The Committee authorization of $9.5 million for phase III construction funds for the SMUD photovoltaics plant is contingent upon the following conditions being met: (1) the contractor (SMUD) will contribute no less than $20 million of its own funds for comple-

tion of phase III of this project; (2) the contractor shall insure that no less than two suppliers provide modules for phase III; (3) the contractor shall insure that no less than two distinct photovoltaic technologies are used for phases III and IV combined; (4) the contractor is encouraged to use more than one photovoltaic technology for phase III alone. The Committee anticipates that $9 million in FY 1986 funds will be required to complete phase III of the project. The Committee is pleased with the progress of phases I and II of the SMUD project, which have been consistently under budget, have established module cost benchmarks for the industry, have led to dramatic reductions in balance of systems costs for photovoltaics utility systems, and will serve as a test bed for a number of advanced photovoltaics technologies upon completion of phase II.

SOLAR THERMAL ENERGY SYSTEMS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Concentrator R&D	3,250	4,550	0	4,550
Materials and components	6,220	8,850	−2,000	6,850
Central receiver R&D	19,980	16,500	+5,500	22,000
Distributed receiver R&D	12,560	7,100	+2,000	9,100
Planning and assessment	1,590	0	+1,500	1,500
Subtotal, operating expenses	43,600	37,000	+7,000	44,000
Capital equipment	250	500	0	500
Total program	43,850	37,500	+7,000	44,500

Solar Thermal Energy Systems (STES) use mirrors or other concentrating devices to convert sunlight to high temperature heat which then drives a turbine or a mechanical or thermal industrial process. The STES program is organized around research, development and testing of two principal STE systems.

Central receiver systems.—A field of sun-tracking mirrors (called heliostats) focuses sunlight on a receiver at the top of a tower.

Distributed receiver systems.—A mirror in the shape of a paraboloid concentrates sunlight on a receiver or receiver-engine combination at its focus.

The program also carries out generic long-term, high risk advanced research and exploratory development on concentrators, materials, and components.

COMMITTEE ACTION

The Committee added $7.0 million to this program primarily for component R&D associated with molten salt and liquid sodium central receiver systems. The recommendation consists of the following elements:

Concentrator R&D.—DOE has requested $4.55 million for research and development directed at lower cost, higher performance concentrators and concentrator materials. The Committee accepts this request, but specifies that at least $2.55 million be directed at parabolic dish concentrators. Concentrators are the most expensive part of the parabolic dish system and have received considerably less development assistance from DOE than heliostats for central receivers or parabolic troughs.

Materials and components.—$2.0 million reduction from solar unique processes. DOE has proposed to spend $3.4 million to "research and develop prototypical components and subsystems [in order] to evaluate concept feasability" of new solar unique processes. This is an increase of $2.2 million over the budget for this item in FY 1984. Although this is a worthwhile activity area, there appears to be no pressing need to increase its funding at this time.

Central receiver R&D.—($5.5 million net increase.) Reductions of $1.0 million from solid particle receiver R&D and $1.0 million from high temperature electric and industrial thermochemical process heat applications are recommended. DOE has been investigating advanced receivers using solid particles, liquids and gases as heat transfer mechanisms. It proposes to increase the budget in this area by $1.56 million in FY 1985, primarily to initiate conceptual designs of the most promising concepts. The Committee reduced this amount by $1.0 million. In thermochemical processes R&D DOE has proposed to increase the budget by $2.56 million, half of which is to "select potential applications and initiate conceptual systems design and economic evaluations." This appears premature, given the lack of results from the R&D phase and the absence of a long-term plan for this activity. Therefore, the Committee cut $1.0 million from this activity.

The Committee recommends an increase of $7.5 million for subsystem component R&D related to molten salt and liquid sodium central receivers and an expanded molten salt electric experiment. The Committee believes that liquid sodium and molten salt central receiver technologies currently involve a degree of risk which is unacceptable to the private sector. The activities proposed in this initiative would reduce that risk by testing and verifying the performance of key components. Sample tasks that could be performed under this initiative include:

—Extended molten salt receiver tests at CRTF to determine lifetime and performance;
—Extended molten salt pump and value tests for performance and reliability;
—Storage tank thermal cycling tests for molten salt storage;
—Design, fabrication, and testing of a sodium steam generator operating in the reheat mode;
—Second generation sodium receiver test and evaluation;
—Development and testing of a prototype sodium heated air rock storage system;
—Development and testing of automated, unattended control systems;
—Expanded testing for the molten salt electric experiment now underway.

Distributed receiver R&D.—$1.0 million increase for module development and $1.0 million increase for operation and testing of distributed receiver experiments. The first $1.0 million of this increase restores parabolic dish module development activities to their FY 1984 levels. The second $1.0 million provides funds to operate and take data from the two small community experiments to be constructed in FY 1984 and the parabolic trough systems tests that have already been constructed.

The Committee believes that the solar thermal dish technology is a very promising solar option. As part of the solar thermal dish program, funds have previously been authorized and appropriated for the constructon of the small community (number one) solar thermal powerplant project (project no. 80–ES–19). In order to proceed with the development of this solar option, the Committee directs the Department to proceed as expeditiously as possible in making the appropriate programmatic decisions with regard to the continuation of this project.

Planning and assessment.—($1.5 million total.) DOE has historically spent $1.5 to $2.0 million on planning and assessment in support of the solar thermal program. This year the DOE request proposes a 4 to 5 percent tax on the subprograms instead. The Committee added $1.5 million to fund this activity as a separate line item, as in FY 1984.

SOLAR BUILDING ENERGY RESEARCH

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Materials and components R&D	8,300	7,200	+2,400	9,600
Systems analysis and thermal science	8,150	4,485	+4,000	8,485
Total, operating expenses	16,450	11,685	+6,400	18,085
Capital equipment	0	200	0	200
Total program	16,450	11,885	+6,400	18,285

This new budget category combines basic and applied research activities formerly carried out in the active and passive solar programs. It also adds new activities recommended to the Committee at its hearings on building energy research and at workshops cosponsored by the Committee, the Department of Energy, and various industry organizations.

COMMITTEE ACTION

The Committee added $6.4 million to the DOE request, distributed as follows:

Materials and components R&D.—Add $2.4 million for additional R&D on active heating and cooling systems. This increase restores cuts from the FY 1984 budget of $0.8 million each in thin film poly-

mer and evacuated tube collectors and absorption chiller materials and components. It also brings desiccant materials and components R&D closer to the $2.5 million level recommended in the staff Multiyear Framework, which was based on internal DOE program planning documents.

Systems analysis and thermal science.—Add $4.0 million for a variety of passive systems related research activities. DOE has proposed to cut systems simulation and analysis, daylighting, heat transfer, passive cooling, performance monitoring and evaluation, and design tools and technology transfer by $0.4 million to $1.2 million each, or roughly 70 to 90 percent. These activities were underfunded in FY 1984 and are strongly supported by the building industry, as part of "whole building performance research." The increase restores each of these activities to a level of about $0.5 to $1.0 million.

WIND ENERGY SYSTEMS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Aerodynamics research	3,800	8,800	−4,300	4,500
Structural dynamics research	2,900	7,700	−2,200	5,500
MOD 2 and MOD 5 programs	18,000	4,200	0	4,200
Cost-shared R&D	0	0	+1,000	1,000
Small system test center	1,500	1,700	0	1,700
Systems analysis	300	700	0	700
Subtotal, operating expenses	26,500	23,100	−5,500	17,600
Capital equipment	0	200	0	200
Total program	26,500	23,300	−5,500	17,800

Since 1973 the United States Government has sponsored research and development in wind energy, aimed at making wind turbines a viable technological alternative to existing electric generating capacity.

A large wind turbine subprogram has developed a series of machines of increasing size and cost-effectiveness, the MOD–OA (200 kw), the MOD–1 (1 Mw), and the MOD–2 (2.5 Mw). This subprogram will terminate with the MOD–5B ma hine currently being designed.

In the small wind area, the government has supported the development of a series of wind turbines from 1 to 40 kw in size. In addition, the government has operated a test facility for small wind machines at Rocky Flats, Colorado.

The DOE program has also been active in developing and testing vertical axis (Darrieus) wind machines and carrying out wind characterization and resource asssessments.

COMMITTEE ACTION

The Committee cut $5.5 million from the wind energy systems budget, distributed as follows:

Aerodynamics research.—Cut $4.3 million. DOE has proposed to increase this activity from $3.8 million to $8.8 million in one year, with no stated rationale for such a large increase. Individual items in the request do not appear unreasonable, but they do not appear to be crucial either. A reduction of $4.3 million still allows a modest expansion of this activity.

Structural dynamics research.—Cut $2.2 million. DOE has proposed to increase this program from $2.9 to $7.7 million, again with no stated rationale for such a large increase. One portion of this increase, to build a new, larger vertical axis test bed, has been documented and justified to the Committee. This project, which will cost about $2.6 million, is included in the Committee authorization. No funds are included for the MOD–O upgrade.

MOD–5.—DOE has proposed to defer $3.0 million in unexpended FY 1984 funds from the now-defunct MOD–5A and apply that deferral toward FY 1985 funding of the MOD–5B. It appears that this sum, plus the $4.2 million requested, is sufficient to fund DOE's FY 1985 share of the existing MOD–5B contract ($6.0 million) plus testing and support at NASA Lewis. The Committee encourages DOE to make more funds available from the MOD–5A contract for use in FY 1985, if possible.

Cost-shared R&D.—The Committee directs DOE to initiate a cost-shared research and development program for manufacturers of small and intermediate size wind systems to resolve outstanding problems with new designs and concepts. Wind system manufacturers will propose research projects to DOE in response to a competitive solicitation, and receive awards for up to fifty percent of the project costs, with a limit of $200,000 on the DOE contribution to any one project. The Committee believes that this program is needed to help the small wind industry overcome the technical problems which have occurred due to the recent rapid scale-up in wind system size from the 50 kw range to the 200 kw range. The Committee authorizes $1.0 million within the Wind Energy Systems program budget for this activity in FY 1985.

The Committee also directs DOE to encourage the Rocky Flats small wind test facility to work cooperatively with wind turbine manufacturers and wind farm operators to provide field testing and technical support for intermediate scale machines.

The Committee is concerned that DOE has proposed to increase its funding for aerodynamics and structural dynamics research at a time when NASA Lewis, the horizontal axis wind turbine R&D support contractor, is planning to terminate its involvement in the Federal wind program. DOE is directed to report to the Committee no later than October 1, 1984, on its plans to manage the horizontal axis wind turbine R&D program when NASA Lewis ceases to carry out its program support activities.

BIOFUELS ENERGY SYSTEMS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Short rotation intensive culture	3,500	4,200	0	4,200
Production research	4,500	6,200	−1,000	5,200
Thermochemical conversion	8,000	7,000	+1,000	8,000
Biochemical conversion	8,400	6,600	+800	7,400
Conversion technology transfer initiative	0	0	+3,400	3,400
Regional biomass program	4,000	3,100	+900	4,000
Subtotal, operating expenses	28,400	27,100	+5,100	32,200
Capital equipment	0	1,000	0	1,000
Total program	28,400	28,100	+5,100	33,200

The DOE Biofuels program has traditionally been about equally divided between two main activity areas.

Feedstock production research and development.—This includes R&D on short rotation woody crops, new herbaceous crops and species, and aquatic species such as kelp and water hyacinth.

Conversion technology research and development.—This includes R&D on new processes for biochemical conversion (anaerobic digestion, fermentation), thermochemical conversion (gasification, direct liquefaction, pyrolysis), and direct production of hydrogen from microbes and enzymes.

In addition, in FY 1983 the DOE was directed to establish regional biomass programs in the Northeast, Southeast, Midwest, and West.

In FY 1984 DOE combined the Biomass, Alcohol Fuels, and Urban Waste programs into one budget category, entitled Biofuels.

COMMITTEE ACTION

The Committee added $5.1 million to this program, primarily for additional conversion technology development activities and for cost sharing on industry financed pilot gasification plants. Details are as follows:

Short rotation intensive culture.—Based on the recommendation of the Biomass Energy Research Association, DOE is encouraged to include harvesting technology R&D in this category.

Production research.—$1.0 million reduction. This program is receiving $2.7 million in additional funding in FY 1985, including $1.0 million in capital equipment. A reduction of $1.0 million will still allow reasonable program progress.

Thermochemical conversion.—Add $1.0 million. The Committee is aware that a Solid Waste Energy Conversion facility built with DOE funds using the slagging pyrolysis incineration process has been shut down and mothballed. The Committee directs that $1.0 million within the Biofuels program be used to reopen the plant

and carry out a cost-shared research and development test of the process, provided the following conditions are met: (1) agreements for private sector cost sharing in excess of fifty percent of the costs of the test will be obtained before any DOE funds are obligated; (2) the total DOE Biofuels contribution to this test shall not exceed $1.5 million over the FY 1985 and FY 1986 time period; and (3) existing contractual obligations for dismantlement of the facility shall not in any way be affected. The Committee also directs DOE to investigate the feasibility of using this facility as a test bed for advanced pyrolysis processes.

Biochemical conversion.—Add $0.8 million to bring funding closer to the FY 1984 level. The Committee believes that the DOE request of $6.6 million is insufficient to fund all needed biochemical conversion R&D activities for biomass, alcohol fuels and municipal solid waste activities.

Conversion technology transfer initiative.—Add $3.4 million for cost sharing of industry sponsored pilot plant(s) using DOE developed technology. It has come to the Committee's attention that several biofuels conversion technologies developed by DOE are approaching the stage where the private sector may be interested in funding scale-up to the pilot plant size. It appears, however, that the risk of building a first-of-a-kind pilot plant may be too great for the private sector to assume on its own. Therefore, funds are provided for DOE to cost-share no more than 40 percent of an industry sponsored pilot plant using a DOE developed technology. The Committee expects that DOE would receive in return the right to collect and disseminate data about the performance of the plant, and to receive repayment if the project is successful.

Regional biomass programs.—Add $0.9 million to restore program to FY 1984 level. This increase funds four regional programs at $1.0 million each, consistent with previous years.

The Committee supports the Department's decision to consolidate urban waste research and development program activities within the biofuels program. However, in order to maintain urban waste program viability, the Committee specifically authorizes a minimum budget of $4.0 million for urban waste R&D activities within the biofuels program. This funding should be directed to continue or support activities in thermochemical and biochemical systems, feedstock preparation, wastewater treatment energy conservation, proof-of-concept development and technology transfer. Program activities should also focus on fundamental combustion characteristics, corrosion, erosion deposition, advanced environmental control technology, and combined urban waste. The Committee believes that water-cooled combustion processes show great promise and should be further investigated.

OCEAN ENERGY SYSTEMS

[In thousands of dollars]

	Fiscal year —		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Materials and structures research	0	1,000	0	1,000
Thermodynamic research	2,900	1,400	+1,500	2,900
Experimental verification and testing	1,700	600	+1,000	1,600
Environmental and oceanographic research	500	500	0	500
Alternative ocean systems	400	0	0	0
Subtotal, operating expenses	5,500	3,500	+2,500	6,000
Capital equipment	0	0	0	0
Total, program	5,500	3,500	+2,500	6,000

The DOE Ocean Energy Systems program has historically had as its primary mission the development and demonstration of at least one closed cycle ocean thermal energy conversion system (OTEC). With the funding of preliminary design for a pilot plant in the FY 1983 budget, the closed-cycle OTEC development program reached a logical termination point. However, the Committee believes that a modest technology base program aimed at long term needs and generic, high risk problems is justified. A recent study and a workshop on OTEC by the Office of Technology Assessment recommended a number of research activities which could be carried out under such a program.

COMMITTEE ACTION

The Committee added $2.5 million to continue all program elements at FY 1984 levels.

Thermodynamic research.—Add $1.5 million. This increase funds additional research on open cycle OTEC (heat and mass transfer, non-condensible gas effects, and systems research) and on thermodynamic materials, especially biofouling and corrosion, low cost heat exchanger materials, and advanced turbine materials. This is consistent with the OTA OTEC workshop recommendation that a level technology base program be maintained in these areas.

Experimental verification and testing.—Add $1.0 million for Seacoast Test Facility modification. The DOE request does not contain sufficient funding to complete the upgrading of the Seacoast Test Facility required to carry out OTEC experiments and to also carry out an experimental testing program. According to internal program planning documents, a minimum of $1.7 million is needed for these activities in FY 1985, including design, fabrication, and assembly of the new components required for the Seacoast Test Facility. These components include upgraded seawater handling systems and measurement and control instrumentation. The Committee action brings this subprogram to $1.6 million. The OTA OTEC workshop supports the creation of a test facility capable of han-

dling the cold and warm water needs for experimental verification and testing.

The Committee directs DOE to prepare a multiyear plan for ocean energy systems research and development directed at long term needs and generic, high risk problems. The plan should be consistent with the findings and recommendations of the OTA staff paper on OTEC and the February 9–10, 1984 OTEC workshop as summarized by OTA in its testimony to the EDA Subcommittee on February 28, 1984. The report should be submitted to the Committee no later than October 1, 1984.

SERI Facility

COMMITTEE ACTION

The Committee added $1.0 million to begin design of a new laboratory building for the Solar Energy Research Institute (SERI).

SERI researchers have been operating in rented space since the inception of that laboratory. This creates a number of problems, including inability to control the laboratory environment, inability to make building modifications needed to fit new equipment, and inability to gain access to the facility at odd hours. It also adds operating expenses to the SERI budget.

SERI management has proposed construction of a new building for laboratories and research offices at a total estimated cost of $25.0 million. The Committee encourages DOE to request funds for the construction of such a facility in the near future.

TAX CREDITS

The Committee believes that appropriate financial incentives can play a significant role in the development of new and advanced renewable energy technologies and more efficient conservation technologies. Various incentives can encourage the private sector to move forward aggressively in the development of promising new energy technologies with minimal federal involvement.

Testimony received during the fiscal year 1985 Department of Energy authorization hearings and other recent hearings clearly indicated strong tax incentives were needed in order to allow for large scale wind, solar photovoltaic, and solar thermal energy systems. These incentives were needed in order to provide infant industries with more predictable markets and ensure that new energy technologies enter the marketplace at the appropriate time of commercialization.

Specifically, the testimony suggested it was necessary to extend the business renewable energy tax credit beyond the current expiration date. These incentives are currently scheduled to expire at the end of 1985. The failure to extend these tax credits could impede the timely development of renewable energy industries and result in a loss of valuable energy exports.

Thus, within six months of the date of enactment of this Act, the Secretary shall submit to Congress a report on the role of research and development and investment tax incentives in the development and utilization of advanced renewable energy and conservation technologies. Such report shall include an estimate, to the maxi-

mum extent possible, of the possible loss of federal revenues as a result of an extension of the current business energy tax incentives for an additional three years. The Committee also encourages the Department to consult with the appropriate federal agencies on a meaningful energy tax program to stimulate the development of these technologies.

Solar Resource Assessment

COMMITTEE ACTION

The Committee added $2.2 million for this activity and identified it as a separate line item in the DOE solar budget. The Committee has received a great deal of information about the effect of budget cuts at NOAA and DOE on this research activity, and the needs of researchers in the field. A consensus statement of the solar radiation research community was presented at the FY 1985 DOE Authorization hearing on February 28, 1984, which included the following recommendations:

1. Restoration of the National Solar Radiation Monitoring Network at NOAA to its 1980 level of activity, including replacement of capital equipment. ($875,000 per year.)
2. Re-funding of existing Solar Energy Meteorological Research and Training Sites at universities, whose funding expired in FY 1982, and possible addition of two new sites. ($440,000 one time; $1,100,000/year thereafter.)
3. Continuation of solar resource assessment research at SERI at an expanded level, as a separate line item in the solar budget, rather than as part of the photovoltaics program ($890,000).

The Committee funded all of these activities at about two-thirds of the levels recommended, as follows:

Meteorological research and training sites.—$1.0 million for 8–10 sites.

SERI research program.—$0.6 million.

NOAA solar radiation monitoring network.—$0.6 million, to be transferred from the DOE solar program to NOAA.

2. GEOTHERMAL ENERGY

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Hydrothermal industrialization	2,000	$0	$0	$0
Geopressured resources	5,000	3,500	+3,500	7,000
Geothermal technology	22,459	22,156	+2,000	24,156
Program direction	1,000	1,031	0	1,031
Subtotal, operating expenses	30,459	26,687	+5,500	32,187
Capital equipment	0	400	0	400
Total program	30,459	27,087	+5,500	32,587

U.S. geothermal resources include steam, hot water, geopressured methane, hot dry rock, and magma. Each successive resource is more expensive and technically more challenging to tap, but each represents an energy source of considerably greater magnitude. The DOE Geothermal Research and Development program is aimed at resolving the technical problems that prevent the private sector from developing the more advanced, higher potential resources. These problems include uncertainties in determining size and life of reservoirs, unusually high drilling costs and lack of well stimulation techniques, the need for injection technology for economic disposal of spent brines, major corrosion and materials problems, environmental problems, and lack of efficient components. The strategy of the program is to work closely with industry to establish needs and priorities, cost-share where possible on R&D projects, plan for technology transfer from the outset, assist in solving problems holding up the technology applications, and provide leadership until the highly fragmented geothermal industry matures. The DOE program is currently divided among three major areas: technology base research in support of the hydrothermal resource; hot dry rock drilling and research at Fenton Hill, New Mexico; and testing and analysis of several design wells to determine the extent, costs, and technical problems remaining for the geopressured resource. A magma energy extraction program was begun in FY 1984.

COMMITTEE ACTION

The Committee added $5.5 million to the DOE request of $27.087 million to bring this program to a total of $32.587 million. The in-

crease consists of $3.5 million for geopressured resources and $2.0 million for hot dry rock.

GEOPRESSURED RESOURCES

The Committee added $3.5 million to this subprogram to fund it at $7.0 million in FY 1985. At that level DOE will be able to operate the two remaining design wells; continue its basic research and archiving activities and acquire and test a deep well, drilled by industry, which has access to hot, high pressure brine.

The Committee believes that upon completion of testing of the design wells, this program can begin to be phased into the private sector. DOE is to prepare for the Committee a plan to gradually reduce federal involvement in this area, particularly in large scale well testing, based on a realistic assessment of when sufficient information will be obtained to resolve the outstanding resource, technology, and economic questions associated with geopressured geothermal systems. The plan shall be transmitted to the Committee no later than October 1, 1984.

HOT DRY ROCK

The Committee added $2.0 million to complete the phase II thermal loop at Fenton Hill, NM and operate if for an extended period to assess reservoir longevity, operating performance, and environmental effects. The increase will enable DOE to re-drill the extraction hole and test the system at the full capacity provided by the December, 1983 fracture experiment.

The Committee believes that once the circular loop is completed at Fenton Hill and all necessary heat extraction experiments have taken place it will be time to begin the transition of this technology to the private sector. The Committee instructs DOE to submit, by October 1, 1984, a plan for transition of Hot Dry Rock activities to the private sector. The plan should include a discussion of future plans for the Fenton Hill site, the desirability of further hot dry rock experiments at alternative sites co-funded by the private sector, and the need, if any, for a long term technology base research program in this area.

3. NUCLEAR FISSION

COMMITTEE VIEW

Nuclear Fission R&D

The Committee is concerned about the future of the nuclear option. The OTA report "Nuclear Power In An Age Of Uncertainty," which was done at the request of the Subcommittee and Committee Chairmen, identified the problems confronting the option and outlined a blueprint for their solution. The OTA report also pointed out the possible role which advanced reactor designs might have in reinvigorating the nuclear program. Since this Committee has primary jurisdiction over nuclear research and development programs, it must decide what is the proper thrust of those programs to support continuation of a healthy nuclear option. Thus, the Committee has emphasized the need for alternative designs which are inherently safe and yet can be proven economically competitive. The Committee has received considerable testimony about the desirability of smaller reactors from a financial perspective as well as those which are inherently safe in the sense that they protect the utilities' plant investment. The Committee recognizes that present commercial Light Water Reactors (LWRs) are very safe and that, in fact, recent research on the so-called source-term has indicated that they are much safer with respect to protection of public health and safety than previously realized in the case of a catastrophic accident. The Committee also believes that alternative reactor technologies can be pursued with vigor by the nuclear industry without threatening the existing investment in operating light water plants and in those under construction.

The Committee is also concerned that significant resources be devoted to a strong Breeder Technology program. However, in this difficult fiscal climate the Committee cannot support the disparity of resources between the Liquid Metal Base Technology program and other advanced reactor programs. The Committee intends that the Department pursue a broad nuclear R&D program which includes technology development for generic work in advanced LWR designs, as well as significant funding to develop technology for Intermediate-term advanced reactor options such as the modular HTGR and the PIUS concept. The ultimate long-term option is the breeder reactor and the Committee is encouraged that innovative concepts, including modular designs, are being explored for Liquid Metal Reactors (LMRs). The Commitee expects that resources will gradually be redistributed within the Nuclear Fission R&D effort to support technology development of the advanced terrestrial reactors, as well as space nuclear reactors, at a level roughly equal to the Breeder Base Technology program. This shift of resources should occur in such a way as to utilize the great expertise that

has been developed through DOE's Nuclear Fission R&D programs among contractors and the laboratories.

The sequence of goals and sub-goals, as specified in the Secretary's Annual Report to the Congress for the Breeder program, has broader implications for the total federal Nuclear Fission R&D program. This program has become more and more a victim of, rather than a corrective influence on, unstable market forces and transient economic pressures. The Committee believes that it is time to carefully re-evaluate these goals and directions in terms of the fundamental task of the federal program, which is to ensure this nation's energy future through the establishment of the technology base needed to preserve nuclear energy's contribution to this future.

The Committee finds that the design of the Department's present R&D program has become overly-subject to vacillating and uncertain market forces. The Committee does not deny the importance of the marketplace in bringing new nuclear fission power systems to productive application; but the degree to which such concerns influence the long-range planning and implementation of tasks within the federal Nuclear Fission R&D program are in question. The Committee essentially concurs with the original statement of thrust delineated in the Secretary's Annual Report. Long-range, high-risk R&D that will produce safer, more economical and flexible nuclear power systems capable of contributing substantially to America's goal of energy self-sufficiency is a proper federal responsibility. Reacting to the nuances of short-term and often fickle commercial markets is not. Planning of the federal R&D program must, therefore, strike a proper balance between addressing the broader national energy policy issues and incorporating market requirements into the planning process.

The Committee view is that an R&D program which addresses intermediate as well as long-term options is required if the Committee is to fulfill its responsibility for authorization and oversight jurisdiction with respect to nuclear energy. The Committee also has been concerned that there is virtually no university effort within Nuclear Fission R&D, although the academic community has put forth some of the most innovative and well thought out proposals for modifying the nuclear enterprise so as to improve its prospects. The Committee has suggested a restructured Breeder Technology program focused on validating several promising advanced designs; this activity should complement a growing development program in converter reactors which includes generic LWR advancements in cooperation with industry and the NRC, as well as a focused, advanced converter effort on the modular HTGR. Finally, the Committee expects that the Space Nuclear Reactor program can be provided sufficient resources such that neither civilian nor defense requirements are limited by the space power sources which are to be available in the 1990s.

CONVERTER REACTOR SYSTEMS

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total Authorization
Operating expenses:				
High temperature gas-cooled reactor (HTGR)	30,000	33,109	+10,891	44,000
Light water reactor (LWR) systems	19,500	16,000	+16,000	32,000
Three Mile Island (TMI)	33,000	30,700	0	30,700
Advanced reactor systems	4,980	0	[1] +4,800	4,800
Program direction	1,190	725	0	725
Subtotal, operating	88,670	80,534	[1] +31,691	112,225
Capital equipment:				
HTGR	0	1,500	+1,500	3,000
LWR	0	0	0	0
TMI	4,000	1,500	0	1,500
Advanced reactor systems	0	0	0	0
Subtotal, capital equipment	4,000	3,000	+1,500	4,500
Construction	0	0	0	0
Total, converter reactor systems	92,670	83,534	[1] +33,191	116,725

[1] $4.8 million increase for Advanced Reactor Systems is contingent upon an appropriate transfer of appropriations from the ACDA budget.

CONVERTER REACTOR SYSTEMS

COMMITTEE VIEW

Inherently Safe Reactors (ISR's)

Modular High Temperature Gas Reactor (MHTGR)

The Committee has recognized that nuclear energy has come to a turning point as a result of several developments in the course of commercial nuclear power deployment. These changes include dramatic increases in the cost of power plant construction, apparent shortcomings in quality control during construction, almost insurmountable difficulties in achieving or maintaining a degree of certainty for the licensing of reactors, and a resultant decline in public acceptance of nuclear energy for peaceful purposes.

In response to these changing conditions, taking into account the termination of the Clinch River technology demonstration project, the Committee has had to reevaluate the research and development emphasis of the nuclear energy program. As a result, the Committee has turned its attention to those reactors with potential for deployment in the intermediate term; those that can meet a range of both the market demands and institutional requirements which may prevail in the mid to late 1990's and beyond. The Committee believes that this next generation of reactors must not only demonstrate advanced performance and be competitive economically but must also embody features which will lead to improved quality, more certain, effective, and timely licensing. These reactors must have such desirable features that both the industry and the

public will recognize that they represent acceptable financial and safety risks. The Committee has encouraged the DOE to recast the overall Nuclear R&D program as an Advanced Reactors program which includes studies of Advanced LWR designs with some supporting research; significant technology development for concepts such as the Modular HTGR and Space Nuclear designs and, for the long-term, technology validation for the several most promising breeder designs.

In reviewing the opportunities for developing a nuclear reactor which can meet these changing conditions, the Committee has turned to the High Temperature Gas Reactor Program. The High Temperature Gas-Cooler Reactor offers certain additional safety features over and above those of the already very safe LWR's. These features included the inert gas coolant which does not change phase in the reactor, the high heat capacity of the reactor core, and the high temperature melting point of the fuel. Taken together, these features constitute a reactor concept which is greatly tolerant of operator errors and operational failure of reactor components. The high degree of safety offered by these features has been verified many times during the operation of the Ft. St. Vrain reactor in Colorado.

Based on the work accomplished to date and the prevailing conditions in the industry, the Committee believes that new directions must be taken which can alleviate a number of factors which currently inhibit the economical use of nuclear power. These include changes in licensing through design standardization and in-factory assembly, recognition of a single entity for furnishing a complete ready-to-operate plant, incremental financing with reduced rate-base impact and balance of plant construction being to commercial standards.

The reactor that currently seems most suited to meeting the needs of the utility industry, and other industries as well, is the Modular High Temperature Gas Reactor. Such a reactor can be built and assembled in a factory, and it will be designed to meet the very strict safety criteria, which is: that it can suffer a complete loss of coolant with simultaneous loss of all active safety systems and not have the fuel melt. What this means is that no fission products would be released which would endanger the public and that no severe damage would result that would cause an intolerable loss of property to the utility or other owner. Such a reactor can certainly be built in the size range of 100–200 MWe and a critical element of the program will be to determine what is the largest size modular HTGR which retains inherently safe features. The Committee also looks to the DOE continuing with an evaluation of a smaller High Temperature Gas Reactor, an Integrated Plant, that would have most, if not all of the safety features provided in a Modular High Temperature Gas Reactor, but which would be constructed in the field and have approximately twice the power output.

CONVERTER REACTORS—HIGH TEMPERATURE GAS REACTOR PROGRAM

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Modular high temperature gas reactor (MHTGR)	0	0	+22,000	22,000
Very high temperature reactor research (VHTR)	0	0	+3,000	3,000
Integrated plant	0	0	+3,000	3,000
Base high temperature gas reactor program	30,000	33,109	−17,109	16,000
Subtotal, operating	30,000	33,109	+10,891	44,000
Capital equipment: Base program	0	1,500	+1,500	3,000
Construction: Modular high temperature reactor (MHTGR) test reactor (site undetermined)	0	0	0	0
Total, high temperature gas reactor	30,000	34,609	+12,391	47,000

High Temperature Gas-Cooled Reactor Program

COMMITTEE ACTION

Net increase of $12.391 million

Modular high temperature gas-cooled reactor (MHTGR)

Increase of $22.0 million

The Department of Energy (DOE) budget states, "The primary thrust of this program will be to evaluate and develop the potential of these small reactors for multiple applications." The Committee agrees with this position for FY 1985. However, the Committee believes that the FY 1985 program activities must be consistent with the planned milestone of having a full-scale prototype MHTGR in operation by 1993. The program should also consider the use of the prototype modular gas reactor to demonstrate the passive safety features of the system. Therefore, the FY 1985 program is to include all work necessary to determine the reference design for the MHTGR and to provide the additional supporting information which would permit the Committee to authorize such a project. This program requires funding above the DOE request and the Committee has added $12.4 million for FY 1985.

This initiative, which is representative of the change in emphasis of the research and development program, will not resolve all the institutional problems associated with nuclear energy. Nevertheless, the Committee believes that the MHTGR at this time offers the best R&D opportunity to ultimately reduce the financial risk factors and planning uncertainties which currently inhibit the utility companies from making further investments in nuclear energy. These systems should be developed to provide economic electric power to the consumer and, at the same time, preserve a nuclear alternative which the public can embrace because of its obvious safety.

In launching the MHTGR Program, the Committee looks to the DOE to staff, organize, and lead a cohesive team involving both industry and utility participation. Their program goals should be toward the successful development, fabrication, assembly, installation and testing of the largest sized reactor that can meet the criteria of passive safety and can also benefit from the factory fabrication, assembly and inspection of major systems. The passive safety goal recommended by the Committee is that the reactor be able to withstand the loss of coolant and the simultaneous loss of active safety systems without fuel melting and release of fission products from the core, and without resulting in a reactor fire.

The intent of the Committee, and one of the primary objectives of this Program, is to establish the MHTGR as a fully licensed reactor concept, with the understanding that it will establish a standard, such that future MHTGR reactors built to the same design can be certified to be licensable in the most simple and expeditious manner. To accomplish this objective, the Committee strongly believes that it is essential that the DOE establish and maintain continuous communications with the Nuclear Regulatory Commission (NRC) and respond to the NRC's licensing requests and requirements. The Committee, however, also looks to the DOE in developing the MHTGR concept to aim at minimizing those aspects of the overall plant which will require direct NRC involvement.

The major responsibility for this progam is with the DOE and the excellence of management and breadth of experience which it can bring to bear on the design, development and testing of both nuclear and non-nuclear systems. To this end, the DOE should give early attention to utility and industry support in the following areas: operating and maintenance criteria; economics; human factors engineering; manufacturing and industrial engineering; quality assurance and control procedures; transportation engineering, etc. Consideration should also be given to the potential of the reactor system for the export market and particularly to those areas of the market where skilled technical personnel may be in short supply and where proliferation issues would be of concern.

The Committee believes that, in order to achieve a successful MHTGR project, all the work must be carefully controlled and coordinated. The Committee does not wish to see the DOE delegate its responsibility "piece meal" to individual contractors, and urges the DOE to select a systems integrator, e.g., a joint venture organization, to function as a project manager who can then be held responsible for implementing the program.

The Committee recognizes a need to establish user criteria as well as to carefully evaluate design options, but looks forward to timely conceptual design decisions and reasonable design and development schedules.

Very high temperature reactor (VHTR)

Increase of $3.0 million

Nuclear reactors, as well as other powerplants, are limited by the materials used in the system. Gas-cooled reactors offer the opportunity to operate at high temperatures because the fuel system and moderator can withstand very high temperatures. However,

other materials vital to a practical VHTR reactor system, such as those used in the reactor vessel, intermediate heat exchangers and reformers, cannot now qualify for the higher temperature operation over the life of the plant. The Committee recognizes that if improvements can be made in design, materials, and heat transfer which could permit high operating temperatures, the VHTR could meet the demands of industries that require steam and process heat above 1000°F and, of those industries, 20% have needs above 1700°F.

The Committee has authorized a modest amount to continue with scientific and engineering research in materials, components, and core geometry which lead to future reactors with higher operating temperature capabilities. The Committee sees this work as ultimately leading to a unique energy source available to American industry, to support their efforts to maintain a strong position in the world market. The Committee is interested in having the program structured so as to optimize the involvement of industry and research institutions. The Committee advises the DOE, therefore, to establish direct lines of communication with all appropriate laboratories and universities in the U.S. who are engaged in high temperature materials work, so that the results of their efforts can be used as building blocks toward developing VHTR technology in the United States.

Integrated plant

Increase of $3.0 million

Based on recent surveys of the utility industry, there is a recognition that the construction of large nuclear powerplants represent an unacceptable financial risk to a utility company and even one that can result in a debt service that might be greater than the net worth of the utility. The utilities also recognize that there is a need for new powerplants in the not too distant future considering retirement of existing plants, an increase in population, and a further shift from liquid and gaseous fuels to electricity. This recognition has created an interest in smaller nuclear powerplants in the size range of about 1200MWt. Work on this Integrated Plant is to be based on past work accomplished under the Lead Plant Project (2240MWt) reactor concept which was supported by the Committee.

The Committee recognizes the institutional barriers which inhibit the success of nuclear powerplants constructed in the field. These barriers include: an unusually complex form of procurement which forces utility companies into becoming totally responsible for the systems integration and contract management which further leaves them without a guarantee to cover systems performance; and overly complex licensing requirements which drain the energy of key personnel by requiring their time to be spent on resolving procedural matters as opposed to directing most of their attention to the "on time within budget" completion of a high quality plant. Many utility companies do not have large cadres of experienced heavy construction management personnel on hand to engage in a one-time high technology construction project; and non-standard designs allow little opportunity for learning about or implementing product improvement "upgrades."

However, the Committee recognizes a need for parallel research and development of a larger reactor than one that can be built and assembled in a factory. Therefore, the Committee authorizes work in Fiscal Year 1985 on such a reactor smaller than present day LWRs and more suited to field construction practices so that it can meet the future needs of utility companies. The work is to consist of evaluating a concept for such a reactor that can meet enhanced safety criteria and also be economical.

High temperature gas reactor base technology program

Decrease of $17.109 million

The Base Technology Program is a generic research and development program for the support of specific gas reactor programs identified in this authorization as well as potential future gas reactor concepts. As such, the purpose of the Base Technology Program is to provide the information, data, and results of evaluations and tests necessary to support reactor programs and assure their success. In carrying out the Base Technology Program, the Department of Energy is to utilize all appropriate existing resources and facilities to the maximum extent possible, including those of the national laboratories, and elements of private industry which have expertise and/or experience in nuclear and other activities which would be relevant to present and future nuclear programs. In this regard, the Committee urges the DOE to review to suitability of personnel and facilities within the Breeder Reactor Program for utilization when they can substantially benefit the High Temperature Gas Reactor program.

The work to be accomplished in the Base Technology program is to include research, development, computer modeling and equipment testing. The Committee recognizes the need for work in the following areas:

Safety and Licensing; Fuel Developing and Testing; Nuclear Core Geometry; Steam Generator Development; Applied Research in Materials; Proliferation Prevention; Primary Circulator Development; Welding Technology; and Secondary System Fault Reduction;

Control Room Techniques including:

Such Human Factors development as: Surround Brightness; Instrumentation Design and Lighting; Information Presentation; Control Placement and Design; Acoustics; Operator Training; Systems Diagnosis; Sneak Circuit Detection; Emergency Simultation; etc.;

Manufacturing Methods; and

Codes and Specifications.

CONVERTER REACTORS—LIGHT WATER REACTOR (LWR) SYSTEMS

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Advanced reactor safety studies	0	1,000	+5,000	6,000
LWR extended burnup	4,500	0	+6,000	6,000
Loft	15,000	15,000	0	15,000
LWR safety	0	0	+2,000	2,000
Advanced LWR designs	0	0	+3,000	3,000
Subtotal, operating	19,500	16,000	+16,000	32,000
Capital equipment	0	0	0	0
Construction	0	0	0	0
Total	19,500	16,000	+16,000	32,000

Light water reactor (LWR) systems

Advanced reactor safety studies

Process Inherent Ultimate Safety (PIUS) Concept

The PIUS is a concept for a reactor which, if proven, could provide an even safer version of commercial nuclear reactors. The concept is based on existing Pressurized Water Reactor (PWR) technology, which is that used in most of the current commercial U.S. reactors. In the PIUS concept, the reactor core is permanently immersed in a pool of borated water in such a manner that the reactor core is caused to be instantly flooded if the reactor in any way malfunctions. Since the borated water causes fissioning activity to cease, and the large volume of the extra borated water absorbs the excess heat, the system is protected from damage. The FY 1985 request included $1 million to study this concept.

COMMITTEE ACTION

Increase of $5.0 million

The Committee has an interest in exploring the PIUS concept and has added $5 million with direction to the Department of Energy (DOE) to undertake engineering evaluations of the system in order to determine if further research and development of this concept is warranted. In order to accomplish this work, the Committee believes that a joint program consisting of a government/industry team should investigate this concept over the next several years to assess its merits and determine the value and extent of any future research and development program. Investigation of the thermal hydraulics, thermal barriers, and core behavior after borated water entry is essential for confirmation of the proposed concept. For this purpose, the Committee proposes that DOE build a non-radioactive scale model, in conjunction with the Tennessee

Valley Authority (TVA) at the Oak Ridge National Laboratory. This concept has been suggested by ASEA/ATOM of Sweden, which has completed certain work on the concept as has TVA. The Committee therefore authorizes this work with the provision that the DOE coordinate the evaluation activities among all participants to avoid duplication of effort. Furthermore, any scale model built should be assembled using Clinch River Breeder Reactor components to the maximum extent practicable. The Committee recognizes the need to build a scale model at full reactor height in order to confirm the practicality of the concept.

LWR extended burn-up

COMMITTEE ACTION

Increase of $6.0 million

This program has been aimed at developing and demonstrating technology which can be used by utilities to improve the utilization of uranium in LWRs. The $6.0 million was added to enter into new contracts and to continue the program with five fuel fabrication vendors. The DOE investment has been nearly $80 million and a large payoff is expected to utility ratepayers from fuel savings and reductions in waste disposal costs.

The Extended Burn-up program shall continue to be conducted primarily by utility/fuel-supplier teams, with the participation of all five U.S. fuel suppliers. It shall concentrate on advanced fuel designs capable of obtaining even higher burn-ups than already commercially available fuel designs. The burn-up goals of the program shall be increased for present and projected future economic conditions and shall, if appropriate, be changed upon completion of the reassessment.

LWR Safety

The LWR Safety R&D activities include the ongoing DOE/international testing program at the Loss of Fluid Test (LOFT) facility in Idaho for which $15 million was requested by the DOE.

COMMITTEE ACTION

Increase of $2 million

A total of $2 million was added for the DOE/EPRI joint program to meet:

1. The need to provide more margin in key areas of safety problems which could lead to an accident causing core damage; and
2. The need to reduce excess margin where safety R&D has quantifiably identified the excess such that a more advanced design is advisable from a safety and reliability standpoint.

The potential for smaller plants to reduce the financial risks to the utility will be evaluated as a key feature of the program.

Advanced LWR Designs

COMMITTEE ACTION

Increase of $3.0 million

The funding is provided to undertake a DOE joint program with industry which complements the Safety R&D program and is aimed at defining improved Light Water Reactor plants, both PWRs and BWRs, with industry cost-sharing (e.g., EPRI) and joint management to assure industrial commitment. The following scope of work has been outlined in terms of the following utility needs:

1. To simplify the LWRs;
2. To make it easier to operate and maintain plants;
3. To develop a more integrated design;
4. To improve reliability;
5. To standardize;
6. To reduce the time and cost of construction; and
7. To improve uranium utilization.

CONVERTER REACTORS—ADVANCED REACTOR SYSTEMS

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses	4,980	$0	[1] +4,800	[1] 4,800
Capital equipment	0	0	0	0
Total	4,980	0	[1] +4,800	[1] 4,800

[1] This authorization is not to duplicate any Arms Control and Disarmament Agency authorization for this activity, and is contingent upon an appropriate transfer of appropriations within the Appropriations Committee.

Advanced reactor systems

Reduced Enrichment Research and Test Reactor (RERTR) Program

This program has as its objective the development of alternative fuel systems to operate research and test reactors with low-enriched uranium fuels.

COMMITTEE ACTION

Transfer $4.8 million request from Arms Control and Disarmament Agency (ACDA) budget to DOE.

The Committee recommendation is contingent on the basis that a duplicate ACDA request will not be made to Appropriations so that the total FY 1985 funding for the Administration's program is just $4.8 million.

CONVERTER REACTORS—THREE MILE ISLAND

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses	33,000	30,700	0	30,700
Capital equipment	4,000	1,500	0	1,500
Total	37,000	32,200	0	32,200

Three Mile Island (TMI)

The overall objectives of the Three Mile Island Program are to develop the technology for recovering from a serious reactor accident, and to conduct R&D that will significantly enhance nuclear powerplant safety and operation. This program is limited to obtaining valuable generic research and development information only. The principle activities include the TMI Waste Immobilization and Reactor Evaluation Program and the TMI Data Acquisition Program.

COMMITTEE ACTION

No change.

ADVANCED NUCLEAR SYSTEMS

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Space and special applications	25,335	25,750	0	25,750
Space nuclear reactor	4,800	4,300	+5,000	9,300
Program director	1,370	1,050	0	1,050
Subtotal, operating expenses	31,505	31,100	+5,000	36,100
Capital equipment:				
Space and special applications	2,400	2,200	0	2,200
Space nuclear reactor	200	200	0	200
Subtotal, capital equipment	2,600	2,400	0	2,400
Construction	0	0	0	0
Total	34,105	33,500	+5,000	38,500

ADVANCED NUCLEAR SYSTEMS

The Advanced Nuclear Systems program is comprised of two main program areas: Space and Special Applications and Space Nuclear Reactor. The Space and Special Applications program is responsible for the development and delivery of nuclear power sources for U.S. military and civilian space and terrestrial missions and for the assessment and maintenance of these nuclear energy sources consistent with the agency health and safety requirements. In FY 1985, a major activity under this subprogram element is the continued development of the isotope power sources for the NASA Galileo spacecraft and the NASA/European Space Agency International Solar Polar Mission. Both spacecraft are planned for launch in 1986.

The Space Nuclear Reactor subprogram element is responsible for supporting the Department's participation in the tri-agency (NASA, DOE and DARPA) Space Nuclear Reactor (SP–100) program. Several reactor systems concepts are presently under study to determine which concept would enhance or enable future civilian and military space missions. This cooperative effort between the civilian and military programs is intended to accomplish the development and evaluation of reactor systems technologies that are generic to the needs of both mission requirements. A key decision is planned during FY 1985 as to whether or not to proceed with a ground engineering prototype demonstration program in FY 1986.

COMMITTEE ACTION

Increase of $5.0 million to the Space Nuclear Reactor (SP–100) program to cover increased technology evaluation and development activities, safety-related R&D, mission definition and initiate long lead time engineering tasks.

COMMITTEE VIEW

Advanced Nuclear Systems

Background.—The Advanced Nuclear Systems FY 1985 budget request is comprised of two main program areas: Space and Special Applications Projects and Space Nuclear Reactor. The major portion of the $33.5M request is allocated to the Space and Special Applications line element ($27.9M) to primarily provide the flight qualified Radioisotope Thermoelectric Generators (RTG) for NASA's Galileo Mission and the NASA/European Space Agency International Solar Polar Spacecraft. The balance of the request ($4.5M) is allocated to the development of Space Nuclear Power Reactors under the tri-agency (NASA, DOE and DARPA) SP–100 program.

View.—The Committee believes that the demands of future civilian and military space missions for substantial increase in power require augmentation of the Department's FY 1985 request by $5.0M under the Space Nuclear Reactor line item. In the civilian missions alone, for example, it is anticipated that future space station power requirements will be on the order of 200 kilowatts of

electricity. Such power levels could be most effectively achieved using compact space nuclear power systems. From a defense perspective, a broad range of space power needs, up to several megawatts, will be predicated upon the availability of nuclear power systems in a timely manner. The SP-100 program will produce a 100 Kwe-size reactor design for future development in FY 1986 and beyond. Additional funds will be required to assure that all technical evaluations and safety-related research activities are completed on schedule.

BREEDER REACTOR SYSTEMS

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
LMFBR	303,600	237,400	−35,000	202,400
Nuclear fuel cycle	31,385	10,922	+23,500	34,422
Water-cooled breeder reactor	35,500	26,300	−3,000	23,300
Program direction	11,492	8,285	0	8,285
Subtotal, operating	381,977	282,907	−14,500	268,407
Capital equipment:				
LMFBR	21,100	16,375	0	16,375
Nuclear fuel cycle	4,000	1,000	0	1,000
Subtotal, capital equipment	25,100	17,375	0	17,375
Construction: LMFBR	16,000	7,800	0	7,800
Total	423,177	308,082	−14,500	293,582

BREEDER REACTOR SYSTEMS

The Breeder Reactor Systems Program consists of three principal subprograms: the Liquid Metal Fast Breeder Reactor (LMFBR), Nuclear Fuel Cycle and the Water-Cooled Breeder Reactor (WCBR) programs. Termination of the Clinch River Breeder Reactor and the Large-Scale Prototype Breeder activities have reduced the LMFBR program to include only the breeder base technology activity. This activity is presently undergoing a reformulation and restructuring in order to direct activities toward the evaluation and development of new design initiatives. These initiatives are intended to address the issues of inherent safety and low cost recently advocated by the Committee leadership, as well as building on the liquid metal base technology program. The Nuclear Fuel Cycle subprogram includes the breeder reprocessing R&D, proof-of-breeding for the WCBR, thorium fuel cycle R&D related to the High Temperature Gas-Cooled Reactor (HTGR), and a new initiative to explore dry reprocessing methods.

The Committee endorses the Department's intent to support, within the base program, the development of new innovative breeder reactor designs in FY 1985 that are to incorporate inherent

safety and low cost features in core fabrication and design, reactor containment structures, coolant distribution systems and heat transport and transfer systems. Also, design standardization is important to achieving cost reductions in plant construction.

The Committee understands that realizing the ultimate economic advantages and achieving safeguard assurances for the breeder reactor are critically dependent on demonstrating a closed fuel cycle closely coupled to the nuclear steam supply system.

The Committee believes that overall reductions in programs costs can be realized by prudent consolidation of activities and operating procedures at the various breeder reactor component test facilities. Also, rescoping of the several activities performed within the power conversion fuel performance and supply and nuclear systems technology projects so as to focus on issues related to verification of the innovative reactor design efforts could lead to cost savings.

Finally, the Committee believes that the extensive resources within the breeder base technology program that include the personnel, facilities, and institutional arrangements that comprise the various activities within the base program be brought to bear upon the broader technological problems facing the nuclear fission R&D programs.

The importance of industry participation in the planning and implementation of a restructured breeder base technology must not be overlooked. The Committee, therefore, believes that the Department should encourage and support the establishment of an industry-based advisory group or organization, patterned after the EPRI Consolidated Management Organization (COMO) that served a similar function for the Large-Scale Prototype Breeder project. Such an institutional arrangement or infrastructure could also serve as the conduit that allows the transfer of Federally-supported and managed advanced technology developments to the private sector user community.

BREEDER REACTOR SYSTEMS—LIQUID METAL FAST BREEDER REACTOR

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
CRBR plant	[1] 40,000	0	0	0
Large-scale prototype breeder	15,000	0	0	0
Base program	248,600	237,400	−35,000	202,400
Subtotal, operating	303,600	237,400	−35,000	202,400
Capital equipment: Base program	21,100	16,375	0	16,375
Construction:				
Base program:				
85–N–600, general plant project	0	5,700	0	5,700
85–N–601, modifications to reactors, various locations	0	1,000	0	1,000
85–N–602, ANL–West physical security upgrades, INEL, Idaho	0	500	0	500

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
83–N–334, safeguards and security assessment improvements, ANL, INEL, Idaho	1,000	600	0	600
Prior-year projects	15,100	0	0	0
Subtotal, construction	16,100	7,800	0	7,800
Total, LMFBR	340,800	261,575	−35,000	226,575

[1] Appropriations transfer of $40,000 has been made from Uranium Enrichment as an emergency interim measure to fund immediate CRBRP termination requirements.

BREEDER REACTOR SYSTEMS—NUCLEAR FUEL CYCLE

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Advanced fuel reprocessing	25,385	7,922	0	7,922
Proof of breeding	3,000	3,000	0	3,000
Breeder reprocessing engineering test	0	0	+20,000	20,000
High temperature gas reactor	3,000	0	+3,000	3,000
Dry process	0	0	+500	500
Subtotal, operating	31,385	10,922	+23,500	34,422
Capital equipment	4,000	1,000	0	1,000
Total, nuclear fuel cycle	35,385	11,922	+23,500	35,422

COMMITTEE ACTION

LMFBR: Decrease of $35 million.

Nuclear fuel cycle: Increase of $23.5 million.

The Committee directs a general reduction of $35.0 million within the breeder base technology program. This reduction is consistent with the Committee's support of a restructured base technology program aimed at validating several innovative breeder reactor designs. $20.0 million of this amount is to be redirected to the Fuel Cycle program element to support preliminary design and construction activities within the Breeder Reprocessing Engineering Test (BRET) program. This program, authorized by the Committee last year, will provide the proof-of-concept data needed to demonstrate the economic and technical viability of integrating a fully-automated, remotely-operated reprocessing and fuel fabrication facility in close proximity to an operating breeder reactor. This work is to be conducted at the Hanford Engineering Development Laboratory utilizing the FMEF and FFTF facilities. In addition, the sum of $500,000 of this general reduction is to be redirected to the evaluation of a "dry" separation process for reprocessing

spent nuclear fuel from light water reactors. This evaluation shall consider both plasma and laser separation techniques. The Committee expects participation from appropriate national laboratories and industy. A total of $3.0 million has also been added to the Nuclear Fuel Cycle program to continue activities in support of the thorium/uranium fuel cycle.

LMFBR Base Program—Test Facilities

Recognizing our national energy R&D priorities and the international emphasis on nuclear breeder reactor development programs, the Committee believes that experience here and abroad supports the wisdom of sustaining a strong government commitment to this effort. The DOE can best build on the unique accomplishments and sizeable investments in breeder technology—in industry and government—by using the excellent, modern experimental and test facilities at the national laboratories and elsewhere to support a broad range of nuclear fission R&D activities. The highly successful performance of these various test facilities has demonstrated that they should be used to develop, test and qualify innovative advanced reactor and component designs to maximize component and system verification and otherwise gain much needed long-term operation and maintenance experience. Supported by the evidence presented to the Congress for over 25 years, the Committee believes that only by pursuit of advanced, practical breeder reactor development efforts, can the country materially strenghten its technological capability. In this way, the nuclear power option can be preserved in the long run by developing a domestic industrial and licensing capability to apply breeder technology when it is needed. This approach should enhance our interactions with the international community, and restore our leadership position in international nuclear power commerce and allow us to shape world-wide non-proliferation policies and practices. For example, the Fast Flux Test Facility in Hanford, Washington has demonstrated that its ability to provide high-quality, long-term irradiation data for a broad range of materials and fuel configurations is unparalleled in the world. The Committee supports continuation of these efforts, with future emphasis on long duration testing of advanced materials and core configurations related to innovative breeder reactor designs. Also, the Committee recognizes the very reliable performance of the EBR–11 in Idaho, the only power producing breeder reactor still operating in this country. This research reactor has been a major contributor to this country's leadership position in developing breeder reactor technology. The Committee supports the Department's intent to commerce preliminary technical and economic investigations and analyses in FY 1985 related to Argonne National Laboratory's Integrated Fast Reactor closed fuel cycle concept for this experimental reactor.

BREEDER REACTOR SYSTEMS—WATER-COOLED BREEDER REACTOR

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses	35,500	26,300	—3,000	23,300
Total	35,500	26,300	—3,000	23,300

The Water-Cooled Breeder Reactor subprogram consists of completing the Shippingport defueling operation in FY 1985 and proceeding into the core evaluation phase of the program.

COMMITTEE ACTION

Decrease of $3 million.

The Committee recommends a $3.0 million reduction in the Department's FY 1985 request for the Water-Cooled Breeder Reactor (WCBR) program. Reactor defueling operations are to be completed in FY 1985. The balance of work remaining to complete this program involves core evaluation studies using non-destructive assay techniques at the Idaho National Engineering Laboratory. Paralleling this effort is the proof-of-breeding activity in which 16 fuel rods will be destructively assayed at the Argonne National Laboratory. This latter activity is funded within the Nuclear Fuel Cycle program.

The Committee's action is based upon its concern that the WCBR program has not manifested any critical role in the major breeder reactor program restructuring presently underway within the Department. It is, therefore, not convinced that this program should continue to enjoy an unquestioned position of pre-eminence within the Breeder Reactor Systems budget. The Committee recognizes the remarkable accomplishments achieved, under the able management of the Naval Reactors program, in demonstrating the viability of the light water breeder reactor and its thorium-based fuel. However, the Department has not been responsive to the Committee's request to institute a dynamic effort to move this technology into the private sector through a well-formulated technology transfer program. The program's managers have argued that an adequate technology transfer activity is already in place. Yet there has been no active participation of the WCBR program team in the ongoing planning needed to develop the appropriate direction for the breeder R&D program. Therefore, there is no clear indication that the vast expertise embodied in the management and technical personnel of the WCBR program can in any way affect this planning. The proposed reduction in funding will stretch-out the core evaluation activity beyond the present FY 1987 completion date.

COMMITTEE VIEWS

Breeder Reactor Systems

Background.—The Department's FY 1985 Breeder Reactor Systems budget request is comprised of three main program areas: LMFBR, Nuclear Fuel Cycle and Water-Cooled Breeder Reactor. The total funding request of $308.1M represents a reduction of $115.1M from the FY 1984 appropriations. No FY 1985 funds are provided for the Clinch River Breeder Reactor or the Large-Scale Prototype Breeder in this budget request. Reductions were also incurred in the LMFBR Base Technology program ($39.2M), the Nuclear Fuel Cycle program ($23.5M) and the Water-Cooled Breeder Reactor program which is being wound down toward orderly termination ($9.2M). An additional reduction of $3.2M is incurred in the Program Direction line item.

Committee view.—Even with the 27% reduction in the Breeder Reactor Systems FY 1985 budget proposal from the FY 1984 appropriations, the Committee questions the advisability of apportioning more than 85% of the nuclear fission reactor R&D budget to the breeder, recognizing the precarious state of the nuclear power industry in today's climate and the high probability that the breeder reactor will not be needed in the domestic marketplace for several decades.

In the Secretary's Annual Report to Congress (September 1983) the role of the Breeder Base Technology program is defined "to establish a sound technology base to enable the private sector to proceed with industrialization and deployment of the LMFBR (Liquid Metal Fast Breeder Reactor)." This statement essentially describes the raison d'etre for this $300–400 program over the past several years. The report goes on further to note that "the program concentrates on areas of technology development that are within existing Government capability but beyond the capability of the private sector."

The idea was to establish and maintain the state-of-the-art in breeder reactor and nuclear steam supply system technologies. The Government provides the resources to support the staffs and facilities required to develop and evaluate the most advanced concepts and designs. Once verified, these technologies were expected to form the basis for industry to bring the LMFBR into the marketplace through plant designs that would be licensable, reliable, and safe with predictable performance and cost characteristics. As regards the Government-owned test facilities to be used in this program, one objective has been to design and modify them in such a way as to make them profitable, thereby enhancing the attractiveness to industry and facilitate their eventual transfer to the private sector.

The Committee questions the credibility of these criteria given the political, social and economic climate that has led to the termination of the central plant (CRBR) technology demonstration project.

Although there has been significant rethinking within the Department on ways to restructure the Breeder Base Technology program within the context of the existing political and restrictive

budget environment, there remains significant room for improvement in the overall planning process.

First and foremost, the Department and the Congress must review the role of the breeder within a changing public perception of the need to preserve, promote and develop nuclear energy for domestic use. Second, the demise of the Clinch River Breeder Reactor Project must be recognized by Department and industry planners as having a profound impact on the future direction of federally-supported nuclear energy research and development activities. Those who continue to argue that, "as the breeder goes, so goes the nuclear power option," must recognize that such a position is no longer tenable. The "post-CRBR" breeder program must be structured in a manner that acknowledges the fact that preservation of the nuclear power option will require consideration of several technological possibilities, including, but not limited to, the breeder. Such considerations most likely will include recognition of the breeder as a long-term option and require defining a technology development program accordingly.

Some historically ingrained notions and policies must also be reviewed. Thus, tenacious adherence by breeder advocates to gigawatt(electric)-size plant designs should be questioned. The Administration must recognize that the nuclear and utility industries are not now, nor will they be in the foreseeable future, in a position to assume the multitude of responsibilities imposed upon them by the existing Breeder Base Technology Development program policy that requires them to take the lead in implementing or marketing federally-supported breeder technology. In addition, a strategy that includes development or modification of test facilities within the federal R&D program for eventual transfer of such facilities to the private sector is not appropriate. Clearly, the Federal Government is an ill-suited and inappropriate entity for implementing profit-oriented enterprises. Such activities could well result in significant deviation from appropriate federally-supported R&D goals. The Committee is concerned that substantive efforts be undertaken to define the direction and scope of the program now that the central plant (CRBR) technology demonstration activity has been terminated.

To meet this challenge, DOE should initiate a nuclear power R&D program planning activity that provides a forum for all parties (government, labs, industry, A&E's, universities, etc.) affected by future actions in federally-supported nuclear power development and implementation of projects to present their views. A subset of this activity, or perhaps a complementary effort, might be the formation of an advisory board of experts comprised of individuals with no vested interest or expectations to review recommendations and advise the Department in its program planning. As relates to the breeder, guidelines governing this planning operation should include the following information.

—Breeder budgets will most certainly decline in FY 1985 and possibly beyond, at least until the perception of need improves.

—The breeder must be viewed as one possible approach along with others (such as the modular HTGR) that will require an infusion of federal R&D funds in order to sustain a dynamic

nuclear power research effort in the present safety and cost-conscious political environment.

—Prior program rationales must be re-evaluated in terms of the present and projected economic and political realities. The breeder should be viewed as a long-term option, requiring innovative design concepts that lead to low-cost, inherently safe powerplants. Justifying the Breeder program solely on the basis that it provides the generic technology base to support industry market decisions appears to be no longer valid. Industry will most likely not be ready to undertake this responsibility for several decades. Government must assure that the options remain viable by (1) involving industry in program planning and management decisions, and (2) exploring innovative design concepts that provide the flexibility to meet changing market conditions.

EBR–II Electricity Pricing

The Committee is concerned that the department is not charging a fair price for the electricity generated at the EBR–11 facility at the Idaho National Engineering Laboratory. The Committee understands the Department is currently receiving 10 mills-KW hour for electricity generated at the site and that the approximate avoided costs in the area is 30–40 mills/KW hour. Since this facility has been certified as a cogeneration facility, the Committee believes that the Department is entitled to and should be recovering the full avoided costs for this electricity.

The Committee estimates that this would raise revenues from the present $400,000/year to approximately $1.2–1.6 million/year. The Committee believes that these additional revenues should be set aside for future decontamination and decommissioning work at the reactor, and for other expenses in the base breeder program. The Committee believes that the Department already has authority to set up a reserve for the D&D work and to retain the revenues for the breeder program. If the Department should conclude otherwise, the Committee will consider the Department's proposals for appropriate enabling legislation.

Clinch River Breeder Reactor Site Activities

The Committee is concerned that the termination of the Clinch River Breeder Reactor Project, and in particular, both the site restoration activities and the disposition of certain components, be accomplished in the most prudent, cost-effective and environmentally sound manner. The site construction activities, including clearing and grubbing, excavation and related activities has left the site in an environmentally unstable condition. If actions are not taken to prevent deterioration of the virgin soil beneath the excavated portions and to prevent serious erosion of loose soil, then the site will, in a short period of time, become useless as a potential location for other research and development activities. The Committee, therefore, believes that the site must be restored to a condition suitable for future use.

The Committee recognizes that there are many possible ways to protect the site, one being to refill the excavation by compacting

the soil in layers while controlling the moisture content. This would be expensive and furthermore, would also increase the cost of any future excavation. the Committee, therefore, requests the Department of Energy (DOE) to investigate the feasibility of a loosely compacted fill with a densely compacted top layer thereby making the task of re-excavation relatively inexpensive. Secondly, the DOE is urged to take the necessary steps to stabilize the soil against erosion.

Utilization of CRBR Components

The Committee requests that the DOE carefully screen its CRBR components inventory to determine which components, if any, could be used in performing certain research on the PIUS reactor concept. While this concept looks especially attractive from the point of view of core protection, there is much to learn about the thermal hydraulics and the behavior of the thermal barriers under operating and transient conditions. Because the PIUS concept is still in the earliest stages, the Committee is interested in DOE performing some basic evaluation work in conjunction with the Tennessee Valley Authority and the nuclear power industry. One possible task might be to build a non-radioactive scale model which could be used to investigate the fluid dynamics together with turbulence, cavitation and barrier stability phenomena. In fact, the scale of the model might well be determined on the basis of available CRBR components. For example, the CRBR reactor vessel might serve as the large borated water reserve pool for the PIUS.

In this regard, the Committee requests the DOE to submit a brief report to the Committee on Energy and Natural Resources of the Senate, and the Committee on Science and Technology of the House of Representatives by October 31, 1984 describing how the CRBR site can be restored and protected, and identifying those CRBR components, along with associated costs, that could be used for PIUS-related research activities.

NUCLEAR WASTE TECHNOLOGY—WASTE TREATMENT

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses	5,600	6,000	0	6,000
Capital equipment	0	300	0	300
Construction	0	0	0	0
Total	5,600	6,300	0	6,300

NUCLEAR WASTE TECHNOLOGY WASTE TREATMENT

The goal of the Waste Treatment program is to develop and demonstrate technologies for the treatment and immobilization of nu-

clear fuel cycle radioactive wastes in a form acceptable for transportation, storage and ultimate disposal in a licensed repository. This program involves identifying and characterizing the types of waste requiring treatment; understanding the regulatory requirements; developing the technologies to treat wastes; testing the developed technology to determine its reliability, efficiency, and adequacy in meeting environmental, safety, and health protection requirements; and providing a technical resource for other programs in designing, constructing, and operating treatment systems for specific wastes of interest to the Department.

COMMITTEE ACTION

No change.

CIVILIAN RADIOACTIVE WASTE MANAGEMENT

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE Request	Total authorization
Operating expenses	10,930	25,140	0	25,140
Capital equipment	500	2,500	0	2,500
Construction	0	0	0	0
Total	11,430	27,640	0	27,640

CIVILIAN RADIOACTIVE WASTE MANAGEMENT

The objective of the Civilian Radioactive Waste Research and Development Program is to provide for spent nuclear fuel storage research and development, including the development of data and demonstration of dry storage of spent nuclear fuel and rod consolidation; research, development and investigation of alternative means for the permanent disposal of nuclear waste, and technical assistance to non-nuclear weapon states in the fields of spent nuclear fuel storage and disposal.

COMMITTEE ACTION

No change.

UNIVERSITY PROGRAM

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses	0	0	+5,000	5,000

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Total	0	0	+5,000	5,000

University Program

COMMITTEE ACTION

Increase of $5.0 million

The Committee authorizes the expenditure of $5.0 million for the purpose of extending and strengthening the role of universities in the Department's nuclear fission R&D program. To date, the Department's Nuclear Energy program has expended less than one-half of one percent of its annual fission reactor R&D budgets in direct support of university-based programs. The committee has identified a profound lack of direct support for departments of nuclear engineering at our major universities. This situation will produce an unacceptable void in qualified nuclear engineers to carry forth the future implementation of nuclear power in this country. In addition, support for education within the National Science Foundation's programs do not cover this shortfall. It is, therefore, essential to establish this base university support within the mainline nuclear fission R&D program of the Department of Energy so that nuclear engineering departments can be research performers in support of the mainline fission R&D program.

The Committee authorizes the expenditure of $1 million in FY 1985 to establish the Willard F. Libby Memorial Nuclear Engineering Education Program. This program shall be initiated in FY 1985 for the purpose of establishing fellowships and scholarships to individuals for study within university departments of nuclear engineering throughout the country.

This program should be administered by an independent, nonprofit foundation. This foundation should be required to establish procedures for administering these fellowships in advanced fission reactor research and development and scholarships to support undergraduate study in nuclear engineering, consistent with Department of Energy policies.

4. MAGNETIC FUSION

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Applied plasma physics	76,790	84,463	0	84,463
Confinement systems	188,050	196,225	+9,200	205,425
Development and technology	78,310	79,600	0	79,600
Planning and projects	48,700	52,800	0	52,800
Program direction	4,600	4,150	0	4,150
Subtotal, operating	396,450	417,238	+9,200	426,438
Capital equipment:				
Applied plasma physics	5,060	4,900	0	4,900
Confinement systems	20,650	17,600	0	17,600
Development and technology	7,740	7,100	0	7,100
Planning and projects	4,350	3,800	0	3,800
Subtotal, capital equipment	37,800	33,400	0	33,400
Construction:				
78–3–a, Mirror fusion test facility (MFTF–B)	30,000	20,100	0	20,100
78–3–b, Fusion materials irradiation test facility (FMIT), HEDL, WA	0	3,000	0	3,000
86–R–301, Tokamak fusion core experiment (TFCX), site undetermined	0	0	0	0
85–GPP, General plant projects	6,500	9,400	0	9,400
Subtotal, construction	36,500	32,500	0	32,500
Total	470,750	483,138	+9,200	492,338

The goal of the Magnetic Fusion program is to develop and ultimately demonstrate the technology for providing electric power from fusion reactors at commercial-scale. This R&D program is unique in the sense that there is a strong requirement for reactor engineering development to go forward in parallel with the research directed toward proof-of-principle for fusion, i.e., the achievement of power generation output in excess of input power to the fusion device. This achievement of the so-called "break-even" point is expected with the Tokamak Fusion Test Reactor (TFTR) at Princeton which began operation in December 1982 and has already provided very encouraging results on energy confinement times as a function of plasma size. The Committee received significant testimony on the Tokamak Fusion Core Experiment (TFCX) which the fusion community has agreed should be the next logical device to be built in the U.S. program. The TFCX would achieve

ignition of the plasma and operate in a long-pulse mode while containing the "burning" plasma. This device will require significant reactor-type engineering development to design and construct, as well as plasma engineering advances to achieve reliable operation.

A total of $10.8 million was identified in the DOE request for TFCX-related activities, whereas the concensus testimony was that $25 million was needed to initiate the project at a healthy level of activity in fiscal year 1985. Most of the TFCX research is contained in the Confinement Systems subprogram. The other major subprograms are Applied Plasma Physics, Development and Technology, and Planning and Projects.

COMMITTEE ACTION

An increase of $9.2 million was added to Confinement Systems to enhance the TFCX support activity in fiscal year 1985. Also $2.5 million was provided within the total, outside of TFCX funding, for cost-shared fabrication of high strength, high conductivity, copper magnetic coils for use in compact toroid ignition experiments.

COMMITTEE VIEW

Cost-Shared Copper Magnetic Development Program

The Committee authorizes and directs the Department of Energy to establish a cooperative industry-government program for the fabrication and testing of high strength, high conductivity copper magnetic coils for use in fusion ignition and burn experiments from funds other than those identified for the TFCX. This program is authorized at $2.5 million for Fiscal Year 1985. The copper magnetic coils to be fabricated and tested under this program should have a conductivity in excess of 55 percent of IACS Copper and yield strength in excess of 150,000 psi, ductility in excess of 6 percent and current densities in the critical toroidal and ohmic heating coils of 20 and 40 kiloamperes/cm^2 respectively. The coils should be actively water cooled and permit steady state operations at temperatures below 200 degrees Centigrade. The fabrication and testing of these coils should be completed by December 31, 1985.

5. ELECTRIC ENERGY SYSTEMS

[In thousands of dollar]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Electric field effects	3,000	3,700	0	3,700
Reliability R&D	3,500	4,500	0	4,500
Systems technology	11,500	9,300	+200	9,500
Program direction	500	432	+68	500
Subtotal, operating	18,500	17,932	+268	18,200
Capital equipment	0	300	0	300
Total	18,500	18,232	+268	18,500

The electric energy systems program supports research aimed at increasing the efficiency, reliability, and adaptability of our nation's electric power transmission and distribution systems. The R&D programs principally focus on: determining the biological health effects of exposure to high-voltage electric fields; providing technical options that will enhance the reliability of the electric network under normal and emergency situations, particularly that of an electromagnetic pulse; and improving system efficiency through the development of new materials, advanced controls, and new design concepts.

COMMITTEE ACTION

The Committee recommends an increase of $268,000 to maintain the integrity of the program at a very base level of activity and staffing, providing the program stability required for more efficient administration and execution.

The following amounts are authorized to be appropriated for the project tasks as shown (dollars in thousands):

A. Electric field effects:	
Biological research	$2.300
Human health analysis	600
Direct current ion analysis	800
Subtotal	3,700
B. Reliability R&D:	
Electromagnetic pulse (EMP)	3,000
Normal/emergency operating concepts	1,200

Failure mechanisms of materials	300
Subtotal	4,500
C. Systems technology:	
High voltage direct current research	3,900
Superconducting technology	2,000
Automation processing concepts	1,000
New materials research	2,400
Battery energy storage test (BEST) facility	200
Subtotal	9,500
D. Program direction	500
E. Capital equipment	300
Grand total	18,500

COMMITTEE VIEW

Electric Energy Systems

The Committee is concerned about providing the kind of long-term funding required to efficiently administer these high-risk R&D programs and to retain the adequate number of technical experts necessary for good project continuity. The Committee also feels strongly that these funding levels are the minimum required to sustain meaningful progress in the respective programs. The Committee continues to support the Hawaii Deep Water Cable program and its reauthorization for FY 1986 and FY 1987. Apaproximately $8.3 million will be required to complete the program; however, these funds will not be required in FY 1985. Authorizations of $7.0 million and $1.3 million are to be made available in FY 1986 and FY 1987 respectively. These out-year authorizations are to be in addition to those projected funds required to maintain base levels of activity and program integrity.

6. ENERGY STORAGE SYSTEMS

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Battery storage	18,000	14,850	+950	15,800
Thermal mechanical storage	7,000	1,300	+3,200	4,500
Program direction	700	453	+247	700
Subtotal, operating	25,700	16,603	+4,397	21,000
Capital equipment	0	500	0	500
Total	25,700	17,103	+4,397	21,500

The energy storage program activities address the development of efficient, cost-effective technologies to store energy from various sources for use in electric vehicles, utility load leveling, alternative fuel generation, industrial heat recovery, and solar-wind conversion.

COMMITTEE ACTION

The Committee recommends an increase of $4.397 million for additional research and development in the following areas:

1.—Continue work on new systems.
2.—Continue work on the iron/air battery.
3.—An increase for zinc/bromine battery development.
4.—An increase for the thermal storage program.
5.—An increase for the chemical/hydrogen systems program.
6.—Continue work on solar thermal energy storage.
7.—Complete the compressed air energy storage program.
8.—Continue orderly completion of the seasonal thermal program.
9.—Complete testing of the superconducting magnetic energy storage (SMES) system.
10.—An increase for adequate staffing.

The following amounts are authorized to be appropriated for the project tasks as shown (dollars in thousands):

A. Battery storage:
1. Technology base research:

Ambient temperature lithium batteries	$500
New systems	250
Phenomena	1,850
New materials and improved components	1,500
Corrosion	1,000

Alum/air	2,000
Subtotal	7,100
2. Technology development:	
Iron/Air	400
Electrochemical	1,800
Sodium/sulphur development	5,000
Zinc/bromine	500
Battery testing—post-test analysis	1,000
Subtotal	8,700
Total—battery storage	15,800
B. Thermal/mechanical storage:	
Thermal energy storage (TES):	
Composite molten-salt phase-change materials	500
Advanced storage and conversion and solid-state heat pumps	500
Chemical/hydrogen energy systems	1,000
Solar thermal energy storage	700
Completion of compressed air energy storage	700
Seasonal thermal energy storage	700
Completion of testing of superconducting magnetic energy storage (SMES)	400
Total—Thermal/mechanical storage	4,500
C. Program direction	700
D. Capital equipment	500
Grand total	21,500

COMMITTEE VIEW

Energy Storage Systems

The Committee is concerned about providing the kind of long-term funding required to efficiently administer these high-risk R&D programs and to retain the adequate number of technical experts necessary for good project continuity. The Committee also feels that these programs need to be given sufficient funding with continuity so as to provide for the completion of projects that represent a substantial R&D investment and are near fruition.

7. SUPPORTING RESEARCH AND TECHNICAL ANALYSIS

BASIC ENERGY SCIENCES

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Materials sciences	125,110	141,480	−1,300	140,180
Chemical sciences	75,500	80,930	0	80,930
Nuclear sciences	37,900	49,755	0	49,755
Applied mathematical sciences	14,670	28,250	0	28,250
Engineering and geosciences	19,000	20,795	0	20,795
Advanced energy projects	9,100	10,810	0	10,810
Biological energy research	10,580	12,490	0	12,490
Program direction	3,970	3,830	0	3,830
Subtotal, operating expenses	295,830	348,340	−1,300	347,040
Capital equipment	24,280	31,120	0	31,120
Construction	17,160	40,070	0	40,070
Total program	337,270	419,530	−1,300	418,230

BASIC ENERGY SCIENCES, CONSTRUCTION

[In thousands of dollars]

Project number	Description	Estimated total cost	Previous appropriation	Fiscal year 1985 DOE request	Authorization recommendations
84-ER-111	Beam lines and support area construction, National Synchrotron Light Source, Brookhaven National Laboratory.	19,700	2,500	10,000	10,000
84-ER-112	Center for Advanced Materials, Lawrence Berkeley Laboratory.	40,250	1,760	10,790	10,790
85-ER-400	General plant projects, various locations	5,750	0	5,750	5,750
85-ER-401	Accelerator improvements and modifications, various locations.	2,400	0	2,400	2,400
85-ER-402	Stanford Synchrotron Radiation Laboratory Enhancement, Stanford Linear Accelerator Center.	13,030	1,240	9,130	9,130
85-ER-403	Ion Collision Facility, Kansas State University, Manhattan, Kansas.	3,400	0	2,000	2,000
Total				40,070	40,070

The Basic Energy Sciences (BES) program supports basic research to broaden the technology base for present and future

energy technologies. This program supports approximately 1300 research projects, either at DOE laboratories or at more than 150 colleges and universities in 45 states, and provides advanced facilities that are used by university and industrial researchers as well as national laboratory scientists. Research is carried out in seven subprograms: (1) Materials Sciences, (2) Chemical Sciences, (3) Nuclear Sciences, (4) Engineering and Geosciences, (5) Applied Mathematical Sciences, (6) Advanced Energy Projects, and (7) Biological Energy Research.

The fiscal year 1985 budget request for BES is $419.53 million, an increase of $82.26 million above the fiscal year 1984 appropriation of $337.27 million, and includes $348.34 million in operating funds, $31.12 million in equipment funds, and $40.07 million in construction.

The fiscal year 1985 request of $348.34 million for operating expenses is an increase of $52.51 million, or about 18 percent above the fiscal year appropriation of $295.83 million. Almost 40 percent will be spent to carry out research at the major BES facilities.

The Materials Sciences, Nuclear Sciences, and the Applied Mathematical Sciences subprograms requested the largest increases for operating expenses. Materials Sciences requested an increase of $16.37 million, including an additional $6.5 million for facilities, $2.7 million for research at the newer major facilities, and $1.7 million for the Advanced Materials Initiative. The Nuclear Sciences subprogram requested an increase of $11.86 million, including over $5.7 million for facilities, $1.4 million for expanded support of the Nuclear Data activity that was formerly supported by the Nuclear Energy program, and almost $4.0 million for the Heavy Ion Fusion Accelerator Research program. The Applied Mathematical Sciences requested an increase of $13.58 million; $6.58 million to expand long-range research in large-scale scientific computing, and $7.0 million to provide for expanding access for Energy Research scientists to state-of-the-art computing capability.

The fiscal year 1985 capital equipment request of $31.12 million is an increase of $6.84 million above the fiscal year 1984 appropriation of $24.28 million. The capital equipment request includes, for the first time, General Purpose Equipment ($2.0 million) for Argonne National Laboratory (ANL). In prior years, the Breeder Program had provided for ANL's General Purpose Equipment.

The fiscal year 1985 construction request of $40.07 million is an increase of $22.91 million above the fiscal year 1984 appropriation of $17.16 million. This request includes an increase of $5.35 million for General Plant Projects (GPP); $5.0 million is to fund ANL's GPP which was formerly provided by the Breeder program. Other increases include the following: (1) $1.14 million for additions and modifications to accelerator facilities; (2) $2.0 million for the Ion Collision Facility at Kansas State University; (3) $7.89 million for the Stanford Synchrotron Radiation Laboratory Enhancement project; (4) $9.03 million for the Center for Advanced Materials at Lawrence Berkeley Laboratory (including $1.6 million for the initiation of the Advanced Materials Laboratory building); and $7.5 million for the second phase of the National Synchrotron Light Source at Brookhaven National Laboratory.

COMMITTEE VIEW

The Committee received convincing testimony, as well as a number of communications from members of the chemical sciences community, that there are outstanding new research opportunities in the areas of chemical catalysis and reactivity. The Department should consider these new opportunities and fund those appropriate to its mission within the available funds provided in fiscal year 1985, and consider these opportunities in its budget submissions for fiscal years 1986 and 1987.

COMMITTEE ACTION

The Committee reduced the Administration's request for Materials Sciences operating expenses by $1.3 million to provide Lawrence Berkeley Laboratory with a total of $2.5 million for photon and optics research and development (R&D). This amount includes operating funds for the Center for X-Ray Optics and Advanced Light Source R&D.

The Committee agrees that the Center for Advanced Materials (CAM) at Lawerence Berkeley Laboratory (LBL) is worth considerable effort and support to produce a unique model in which industry, universities and a National Laboratory can work together for the benefit of the Nation. Consequently, the Committee approves funding for CAM activities, including construction of the Surface Science and Catalysis Laboratory (SSCL) and conditional funding of the Advanced Materials Laboratory (AML), as proposed by the Department in its fiscal year 1985 budget.

In consonance with the findings and recommendations of the *ad hoc* Panel appointed by the Director of the Office of Energy Research in late March 1983, the Committee strongly endorses the timely completion of the SSCL; however, the *ad hoc* Panel recommended deferral of the AML until the subsequent review of an acceptable CAM program plan for its use. The Committee observes that the original scope of the AML was predicated upon the approval of the construction of the Advanced Light Source (ALS) adjacent to the AML; the *ad hoc* Panel concluded, and LBL and the DOE have agreed, that the CAM and the ALS each be considered on its own merits.

With the above considerations, the Committee directs that prior to the initiation of AML construction-related activities in fiscal year 1985 or in subsequent years, the Department shall conduct a thorough and formal scientific and programmatic review of CAM activities related to the AML and submit a report to the relevant committees of Congress attesting to that review and the need for AML based on CAM requirements.

The Committee notes that construction and operation of facilities as well as facility-based research support requires a significant and increasing portion of the Basic Energy Sciences program's funding. This is most pronounced for the Materials Sciences subprogram, but is also true of the Chemical Sciences and Nuclear Sciences subprograms. The Committee reiterates its concern about the need for long-range planning and priority setting for the Basic Energy Sciences program, particularly as it relates to facilities, and once again directs that the Department, in conjunction with the appro-

priate scientific advisory groups, develop a long-range plan for overall research priorities, facilities construction and operation, and facility-based research.

Such a plan shall be presented to the Committee by December 31, 1984, and shall contain, as a minimum, specific rationales for continued operation and support of existing facilities, a prioritized list of facilities anticipated to be proposed for the remainder of the decade, and estimates of funding requirements to implement the plan.

Within available funds, $1.0 million in the Applied Mathematical Sciences program is authorized to establish a state-of-the-art computing facility as described in the Committee action section of the Nuclear Physics program.

OTHER SUPPORTING RESEARCH AND TECHNICAL ANALYSIS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Energy research analysis	2,869	3,000	0	3,000
University research support:				
University reactor fuel assistance	1,500	1,900	+1,250	3,150
University/national laboratory cooperative research	3,500	6,550	0	6,550
Energy manpower assessments	270	450	−180	270
Energy education and training	200	300	0	300
Subtotal, university research support	5,470	9,200	+1,070	10,210
University research instrumentation	4,000	6,000	0	6,000
Advisory and oversight program direction	3,400	2,900	0	2,900
Total operating expenses	15,739	21,100	+1,070	22,170
Construction, multiprogram general purpose facilities	42,100	38,950	0	38,950
Total program	57,839	60,050	+1,070	61,120

MULTIPROGRAM GENERAL PURPOSE FACILTIES, CONSTRUCTION

[In thousands of dollars]

Project No.	Description	Estimated total cost	Previous appropriations	Fiscal year 1985 DOE request	Authorization recommendations
82-E-302	Security facility, Argonne National Laboratory	8,100	7,000	1,100	1,100
83-E-308	Rehabilitate power systems, Oak Ridge, Idaho, Richland and Lawrence Livermore National Laboratories.	15,830	12,988	2,842	2,842
83-E-309	Electronics facility, Argonne National Laboratory	8,500	5,350	3,150	3,150
83-E-310	Utility replacements and upgrade, Brookhaven National Laboratory.	12,000	8,800	3,200	3,200
84-ER-101	Rehabilitate Old Town area utilities, Lawrence Berkeley Laboratory.	4,750	1,000	3,750	3,750

Project No.	Description	Estimated total cost	Previous appropriations	Fiscal year 1985 DOE request	Authorization recommendations
84-ER-102	Cooling water facilities, Oak Ridge National Laboratory.	4,000	600	3,400	3,400
84-ER-103	Road repair, Richland, Lawrence Berkeley, Idaho and Argonne National Laboratories.	16,000	3,000	4,500	4,500
85-R-701	Central chilled water facility, Brookhaven National Laboratory.	15,000	0	3,500	3,500
85-R-702	Replace lab roofs, Argonne National Laboratory	9,800	0	3,508	3,508
85-R-703	Electrical distribution system restoration, Oak Ridge National Laboratory.	2,200	0	1,100	1,100
85-R-704	Rehabilitate underground steam system, Argonne National Laboratory.	3,000	0	3,000	3,000
85-R-706	Medical facility replacement, Lawrence Livermore National Laboratory.	7,300	0	1,600	1,600
85-R-707	Replace site fire alarm system, Richland Operations	4,850	0	1,300	1,300
85-R-709	Establish central chilled water plant, Argonne National Laboratory.	5,200	0	1,000	1,000
85-R-711	Upgrade environmental monitoring, Oak Ridge National Laboratory.	3,500	0	1,000	1,000
85-R-712	Modify central chilled water plant, Oak Ridge National Laboratory.	4,700	0	1,000	1,000
Total				38,950	38,950

ENERGY RESEARCH ANALYSIS

The Energy Research Analysis program provides (1) analyses and assessments of the DOE's technical needs, opportunities, and R&D programs; (2) coordination and direction in interagency activities such as acid rain; (3) issues and alternatives to support policy decisions; and (4) support to agency advisory groups such as the Energy Research Advisory Board (ERAB). In order to meet its objectives, this program uses the best available in-house, industrial and academic scientific and technical talent in studies, workshops, and panels. The fiscal year 1985 request for this support program is $3.0 million, an increase $131,000 above the fiscal year 1984 appropriation of $2.869 million.

COMMITTEE ACTION

No change.

UNIVERSITY RESEARCH SUPPORT

The University Research Support (URS) program consists of three subprograms: (1) University/National Laboratory Cooperative Research, (2) University Reactor Fuel Assistance, and (3) Energy Manpower Development. University/National Laboratory Cooperative Research aims at strengthening the energy research capabilities of both universities and national laboratories mainly by sponsoring joint research efforts between scientists from these institutions. University Reactor Fuel Assistance provides fuel for university research reactor facilities. Energy Manpower Development includes efforts to increase the number of students pursuing energy-related engineering and science careers, and fulfills the DOE's stat-

utory responsibility for assessing the supply and demand of manpower for both current and projected energy R&D programs.

The fiscal year 1985 request for the URS program is $9.2 million, an increase of $3.73 million above the fiscal year appropriation of $5.47 million. This request includes $6.55 million for University/National Laboratory Cooperative Research (up $3.05 million from the fiscal year 1984 appropriation of $3.5 million), $1.9 million for University Reactor Fuel Assistance (an increase of $400,000 from the fiscal year 1984 appropriation of $1.5 million), and $750,000 for Energy Manpower Development (up $280,000 from the fiscal year 1984 appropriation of $470,000). These increases will provide (1) support for about 50 percent more faculty and student appointments at the national laboratories than the fiscal year 1984 level for University/National Laboratory Cooperative Research; (2) fuel for two additional (up to 6) university nuclear research/training reactors; and (3) increased coverage of energy manpower supply/demand studies and additional Prefreshman Engineering Projects for minority/women high school students.

COMMITTEE ACTION

The Committee reduced the Administration's request for Energy Manpower Assessments by $180,000 to maintain the program at the fiscal year 1984 appropriation. In addition, the Committee added $1.25 million to the University Reactor Fuel Assistance program.

The Committee concurs with the Nuclear Regulatory Commission and the Department of Energy that an orderly change-over to the use of low enriched uranium (LEU) fuel from highly enriched uranium (HEU) fuel in university research reactors is an appropriate course to follow when the reactor can continue to effectively and safely operate as designed, and the costs of conversion are reasonable. The Committee also recognizes that such a switch to LEU fuel must be done on an orderly basis to minimize the cost per reactor, not endanger the future of university research programs using such reactors, and not lower the quality of experimental work being performed.

Given the above considerations, the Committee directs that as a first step $1.25 million be provided for the 23 universities currently using HEU fuel for them to commence analytical studies which could lead to the utilization of LEU fuel on a timely basis. Such studies would include the analysis necessary to assure that reactors could be productively and safely converted to LEU fuel and provide the basis for any required NRC license modifications. In addition, the Department of Energy is directed to complete a comprehensive cost assessment of the budget impact of converting each of the university research reactors serviced to LEU fuel and report to the Committee on the results of this assessment by December 31, 1984 so that the Committee can determine the optimal distribution of funds in the fiscal year 1986 budget process.

UNIVERSITY RESEARCH INSTRUMENTATION

The University Research Instrumentation program supports university research groups on a competitive basis for the purchase of

major, state-of-the-art scientific research instrumentation. The focus is on those university research groups which have already demonstrated expertise in one or more energy-related topics of special concern. The $6.0 million requested for fiscal year 1985, an increase of $2.0 million above the fiscal year 1984 appropriation of $4.0 million, will enable an estimated 10 to 20 institutions to obtain specialized instrumentation items costing $100,000 or more.

COMMITTEE ACTION

No change.

ADVISORY AND OVERSIGHT PROGRAM DIRECTION

This program provides the personnel resources required by the Director of Energy Research to (1) advise on research activities carried out by any of the Assistant Secretaries; (2) support the Energy Research Advisory Board and the Laboratory Management Council; and (3) manage the Energy Research Analysis, University Research Support, University Research Instrumentation, and Multiprogram General Purpose Facilities programs. The fiscal year 1985 request for this support activity is $2.9 million, a reduction of $500,000 from the fiscal year 1984 appropriation of $3.4 million.

COMMITTEE ACTION

No change.

MULTIPROGRAM GENERAL PURPOSE FACILITIES

The Multiprogram General Purpose Facilities (MGPF) program provides for the rehabilitation and replacement of multiprogram general support facilities (roads, railroads, site utilities, and support buildings such as laboratories, office buildings, shops, and warehouses) at DOE's multiprogram sites (Ames Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Hanford Engineering Development Laboratory, Idaho National Engineering Laboratory, Lawrence Berkeley Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Pacific Northwest Laboratory, Richland Operations, and Sandia National Laboratories). The fiscal year 1985 request for MGPF of $38.95 million, a decrease of $3.15 million from the fiscal year 1984 appropriation of $42.1 million, includes $21.942 million for the completion or continuation of seven projects started in previous years, and $17.008 million for nine new projects.

COMMITTEE ACTION

No change.

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8. ENVIRONMENTAL R&D

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Environmental, safety, and health	30,505	35,588	−2,000	33,588
Biological/environment research	173,250	178,116	+17,550	195,666
Liquified spill test facility	3,250	2,000	0	2,000
Subtotal, operating expenses	207,005	215,704	+15,550	231,254
Capital equipment	9,900	9,500	0	9,500
Construction	2,400	3,000	0	3,000
Total program	219,305	228,204	+15,550	243,754

The Department of Energy's environmental program was established to assure that the environmental research, assessment, and control issues related to current and developing energy technologies are addressed effectively. The program is divided into two major categories: Environment, Safety and Health and Biological and Environmental Research.

The principal focus of the Environment, Safety and Health activities has been recently sharpened to emphasize environmental protection, safety, and health protection in the Department of Energy's operations. The Department's nuclear energy and defense programs have received particular attention. The refocusing began as a result of a Departmental examination of safety lessons that could be learned from the Three Mile Island incident, and which could be applied to the operation of DOE nuclear facilities.

The human health effects and environmental consequences that may result from new and existing energy sources are concerns shared by the whole country. The Biological and Environmental Research program is the only long-term, multi-disciplinary research effort in the Federal Government specifically devoted to studying these issues. The goals of this research are to identify, before a technology is locked into place, the early and late effects on human health and the environment. Solutions to these problems, if obtained early enough, will permit energy requirements to be met with minimum damage to human health and the environment.

The Liquified Gaseous Spill Test Facility program, originally in the Environmental Safety and Health Division, is designed to develop information needed about the accidental release of liquified natural gas, hydrogen, chlorine and ammonia.

ENVIRONMENT, SAFETY AND HEALTH

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes in DOE request	Total authorization
Operating expenses:				
Nuclear safety	11,500	16,200	−2,000	14,200
Quality assurance and standards	900	950	0	950
Operating safety	8,830	9,200	0	9,200
Environmental compliance	1,500	1,700	0	1,700
Environmental analysis	2,400	2,600	0	2,600
Program direction	5,375	4,938	0	4,938
Subtotal, operating expenses	30,505	35,588	−2,000	33,588
Capital equipment	1,600	1,500	0	1,500
Total program	32,105	37,088	−2,000	35,088

The Environment, Safety and Health Program (ES&H) provides an independent overview and assessment of the Department's management of contractor-operated facilities to assure safe and healthful workplace conditions, the safety and health of the public, protection of the environment, and compliance with applicable ES&H-related statutory and regulatory requirements in the Department's facilities and operations. The program also assures that energy issues compatible with national energy goals are considered in the development of proposed environmental requirements.

The responsibility of the program is met through the several principal activities descussed below.

1. Nuclear safety.—The nuclear safety program assures an independent, aggressive overview of the Department's complex, which includes 73 nuclear reactors and criticality facilities and over 200 other diverse and highly technical nuclear process facilities, with replacement value of tens of billions of dollars.

COMMITTEE ACTION

The Committee recommended that the Nuclear Safety program element be funded at a level of $14,200,000, which is $2,000,000 below the Administration's request. The amount decreased ($2,000,000) was redirected to the Biological and Environmental Research program. The fiscal year 1985 budget request was an increase of forty-one percent over the 1984 appropriation level. The Committee recognizes the importance of maintaining an excellent nuclear safety program, however it was concluded that the requested increase exceeded the capacity of the program to efficiently and effectively accommodate this rate of growth.

2. Quality assurance and standards.—The objective of the quality assurance program is to provide that research and production activities are performed in a controlled manner, that components, systems, and processes are designed, developed and operated according to appropriate requirements. Such requirements are typi-

cally defined by national standards. Assurance is provided principally through internal policy coordination and the regular performance of independent overview and management appraisals.

3. Operational safety.—The goal of the operational safety program is to assure that the Department of Energy is in conformance with environmental protection, safety, and health protection policies, laws and principles, and that the Department maintains high quality performance levels in its operations. The overall performance of DOE in regard to environmental, safety and health is assessed through collection and analysis of monitoring and incident data for DOE field and headquarters operations.

4. Environmental compliance.—The environmental compliance element implements an independent review program to assure Department compliance with the National Environmental Policy Act (NEPA) and other environmental requirements bearing on project development activities. NEPA and implementing regulations require that Federal agencies prepare and consider in decisionmaking NEPA review documents, i.e., environmental impact statements and environmental assessment.

5. Environmental analysis.—The environmental analysis program provides a Departmental focal point for analysis of current and emerging environmental issues, laws, regulations, and technologies that impact U.S. energy supply and Departmental policies, plans, programs, and facilities. It analyzes and coordinates the Department response to regulatory proposals that may impact energy activities.

6. Program direction.—This program element includes the salaries for 95 full-time equivalent personnel, lump sum payments upon retirement, overtime, equalization pay, incentive awards, and severance pay. Also included in this activity, are the normal agency contributions to benefits and the travel directly related to program accomplishments.

7. Capital equipment.—This program element is in support of the environment, safety and health programs' operating activities conducted at seven national laboratories and 16 dedicated Department-wide contractors. A wide variety of capital equipment is required to pursue the diverse program of research and assessment of environment, safety and health impacts of energy production.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes in DOE request	Total authorization
Operating expenses:				
Source and dose determination	10,161	10,300	0	10,300
Environmental fate and behavior	28,267	32,726	+750	33,476
Health effects	62,683	57,274	+15,000	72,274
Basic biology	22,895	28,207	0	28,207
Risk analysis	1,800	0	+1,800	1,800
Nuclear medicine	19,700	20,665	0	20,665

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes in DOE request	Total authorization
Carbon dioxide	12,500	13,418	0	13,418
Program direction	3,600	3,475	0	3,475
Operating costs	11,644	12,051	0	12,051
Subtotal, operating expenses	173,250	178,116	+17,550	195,666
Capital equipment	8,300	8,000	0	8,000
Construction	2,400	3,000	0	3,000
Total program	183,950	189,116	+17,550	206,666

The Biological and Environmental Research program is the only long-term research effort specifically focused on energy-related health and environmental issues on a nationwide basis. One goal of this research program is to provide scientific data, through basic and applied research, that is necessary to reduce the health and environmental uncertainties associated with the Nation's energy technology and weapons development needs. A second program goal is to develop new applications of nuclear science and technology for use in diagnosis and treatment of human diseases. The programs are divided into several subprograms, described below.

1. Source and dose determination—

A major objective of the source and dose determination research program is to understand and to reduce potential human and ecological effects from energy technologies. A key step in estimating health effects involves a determination of the exposure that humans or the environment may receive. To accomplish this, three research activities are required. They involve analytical studies to define the physical and chemical nature of biologically active agents associated with energy technologies. These provide the data necessary for understanding the subsequent environmental transport of these agents and estimation of population exposure. In addition, research is conducted to improve techniques for the direct measurement of human exposure to ionizing radiation or to energy related chemicals. Finally, a measurement science program is developing new or improved instrumentation techniques required to address a broad range of human and ecological health effects problems related to energy technologies.

COMMITTEE VIEWS

The Committee expressed concern that research to evaluate biological activity, including cancer and mutation effects, in complex chemical mixtures from synthetic fuel processes was being substantially reduced. Over the past few years research on the human and ecological effects of synthetic fuel related technologies has been decreased by DOE. However, it is important to maintain a modest research program because a significant interest in synfuels still exists. The Committee recommended that this research be continued on a long-term basis.

2. Environmental fate and behavior—

This program focuses on understanding how biological active substances, isolated from energy related technologies are transported and transformed in the environment as they move from the source of origin to the site of impact or the receptor. Information obtained from these studies is used to determine the probability of human exposure and estimate potential impact on human health and environmental quality. This program category includes atmospheric, terrestrial and aquatic research which will determine the pathways and mechanisms whereby energy-related agents move through the environment.

COMMITTEE ACTION

The Committee recommended that the Environmental Fate and Behavior research program be funded at $33,476,000, which is $750,000 above the Administration's budget request. The Committee recommended that the research program in high altitude sampling be maintained and directed the increase in funds toward this effort. This program, which began in the 1950's, provides data on the atmospheric concentrations of various pollutants that cannot be obtained by any other method. The Committee found that the scope and focus of the high altitude monitoring program are unique and that the program contributes valuable information on carbon dioxide, flurocarbons and sulfate build-up along with atmospheric radioactivity levels.

The Committee also recommended that of the funds authorized for acid rain research $2,000,000 be directed toward aquatic and terrestrial effects studies and toward understanding of short- and long-range transport of sulfur and other acid rain precursors. DOE has laboratory facilities capable of conducting this type of research. The Committee recommended strengthening the Agency's acid rain research by increasing the research effort in studying the linkage between environmental acidity levels and the responses of the various components of the ecosystems.

Another research area that the Committee expressed interest in strengthening was in pollutant transport. Specifically, funds were directed toward the use of non-radioactive isotopes, such as sulfur, to study atmospheric chemistry and transport modeling related to emissions from fossil fuel power plants.

3. Health effects—

The objective of this research program is to develop a solid base of knowledge to increase understanding of human health risks that may result from exposures to ionizing radiation or to energy-related chemicals. Since the most common human exposures are of the chronic, low-dose type, this program emphasizes research on cancer, heritable defects that are transmissible to offspring, and other delayed or late-occurring health effects that may be associated with such exposures.

Epidemiologic (population) studies provide indispensable information on human responses to toxic agents from energy related technologies. Human populations suitable for study are always limited, and information gained when such studies are possible is typically uncertain and incomplete. Therefore, it is necessary to supplement human studies with systematic re-

search on health effects in experimental animal species and in molecular and cellular level biological systems. Since no single animal species is an adequate human surrogate, it is necessary to conduct animal research on a comparative, multispecies basis. By understanding species differences in patterns of response at the subhuman level, animal data may be more meaningfully related to humans.

It is also important to understand how toxic agents interact with molecules and cells of different species to produce changes leading to the appearance of harmful effects. If an animal model responds to a toxicant in a manner analogous to man and a common mechanism of action exists for the two species, it is possible to make extrapolations from the experimental animal model to man with greater confidence. Therefore, a sound program of health effects research must include a family of interrelated studies that range all the way from understanding the molecular and cellular mechanisms to the statistical analysis of health indices in human populations. Only in this way, can human health risks be adequately understood and predicted.

COMMITTEE ACTION

The Committee recommended that the Health Effects research program be funded at $72,274,000, which is $15,000,000 above the Administration's budget request. The increase is directed toward maintaining the level of effort in health effects research. The Committee believes that a strong research program in the health effects of pollutants resulting from various energy related technologies is very important. Research efforts in this program have not kept pace with the development and utilization of energy technologies in the United States. The Administration recommended a decrease of seven percent ($5.4 million) for this program which the Committee believes is inadequate to continue the level of effort necessary to understand the human health effects of various energy pollutants. The impact of this requested cut would be to impair seriously long-term research programs at several dedicated laboratories. In addition to the funds requested by the Administration for these programs the following amounts were authorized:

a. $3,700,0000 to the University of California at Los Angeles to continue research in biomolecular and cellular biology related to cancer and other health effects and to continue research in the use of tomography with brain and heart disease. Other research programs in cancer detection and diagnosis, neurological and cardiovascular functions are to be continued.

b. $3,500,000 to Brookhaven National Laboratory to maintain research efforts in animal and human inhalation toxicology and to maintain research on the causes and cures of human pulmonary diseases.

c. $1,540,000 to the University of Rochester to continue research in the areas of biophysics, radiation biology, and toxicology.

d. $4,000,000 to Oak Ridge National Laboratory to maintain research efforts in the health effects, including studies in

cancer and mutations, of pollutants produced by energy related technologies.

e. $2,260,000 to the University of California at Davis to continue research on the health effects of exposure to radiation and non-nuclear pollutants resulting from energy related technologies and to continue inhalation studies on toxic substances.

4. Basic biology—

The objective of the basic biology research program is to provide fundamental information on biological structure and function and to develop an understanding of the biological mechanisms which underlie the human health effects of radiation and energy-related chemicals. To this end the research is focused on structural biology, molecular biology, and cell biology.

5. Risk analysis—

The objective of the risk analysis program is to support the formulation and management of environmental research by providing realistic analyses of concerns regarding potential health and ecological impacts of emerging energy technology. By identifying critical sources of uncertainty underlying potential environmental concerns, these analyses assist research managers in identifying those areas for which more information is required for a better understanding of energy-related impacts on human health and environmental quality.

COMMITTEE ACTION

The Committee recommended that the Risk Analysis program be funded at a level of $1,800,000, an increase of $1,800,000 above the Administration's request. In the FY 1984 budget recommendation the Committee restored funding in risk assessment research, for which the Administration had requested no funds. Careful analysis of the program showed that for nuclear and non-nuclear energy technologies, risk assessment is necessary. The Committee finds that the program, designed to analyze potential long-term health and ecological impacts of advanced energy technologies, is important and should be continued.

6. Nuclear medicine—

The objective of the nuclear medicine research is to develop information which will permit evaluation of the feasibility of utilizing specific radiation and radioisotopes in medicine.

Within the Federal Government this program and the Department of Energy's facilities for conducting research in this area are unique. Liaison is maintained with Federal agencies (principally the National Institutes of Health and the Food and Drug Administration), the radiopharmaceutical industry, and the medical community regarding the requirements and the effective use of these techniques in medical research and practice.

The program has, over the years, provided information which has led to widespread use of radioisotopes for improved diagnosis and treatment of human diseases.

7. Carbon dioxide research—

The carbon dioxide research program is designed to develop a sound, quantitative atmospheric carbon dioxide knowledge

base to aid in energy policy decision making. This program is designed to improve the understanding of the fundamental scientific relationships between carbon dioxide concentration and climate; this is accomplished by increased data collection, improved measurements, and development of reliable models. With such data, questions about the relationships between future atmospheric levels of carbon dioxide, the magnitude of climate change and the responses of crops and ecosystems to higher carbon dioxide levels can then be answered with confidence.

COMMITTEE VIEWS

The Committee found that the level of research effort in the area of understanding the role of the oceans in the carbon cycle should be accelerated and directed the Agency to increase these studies.

Recent experience in studying such major environmental problems as the carbon dioxide "greenhouse" effect have demonstrated the importance of analyzing and quantifying interactions which occur at the interfaces between the atmosphere, the oceans, the land masses, and biological organisms. These interfaces often account for the major uncertainties in resolving technical and scientific problems and in defining options for energy management policies.

The International Geosphere Biosphere Program (IGBP), recently described by the National Academy of Sciences, offers the opportunity to develop greater cooperation between traditional scientific disciplines in building a framework which will focus on understanding the interactions between major systems. Patterned after the highly successful International Geophysical Year in 1957–58, IGBP emphasizes the need to achieve participation by other countries as well as by other relevant Federal Agencies.

The Committee has examined DOE's programs and has concluded that these have the potential to make a major contribution to IGBP. It is crucial to draw upon the strengths of the academic community in formulating the U.S. role in this program. Resources spent by DOE in these areas will achieve a substantially greater value if coordinated with an overall observation and research effort.

The Committee urges DOE to cooperate with other agencies to support IGBP in defining its scope and objectives and in developing future plans. The Committee looks with anticipation to the international acceptance of IGBP as a meaningful framework within which resources can be focused.

8. Program direction—

This program element includes salaries, benefits, travel and related personnel costs for 54 full-time equivalent employees. This staff directs, manages, and supports a comprehensive multidisciplinary research effort designed to understand the long-term health and environmental effects associated with the development and use of fossil, nuclear and renewable energy technology options.

9. Capital equipment—

The capital equipment request for the Biological and Environmental Research program are for the support of facility operations. The equipment is utilized in areas of research on health and environmental issues associated with energy technologies and on research and advances in the development of nuclear medicine technology.

10. Construction—

Construction funds for the Biological and Environmental Research program are requested in support of the program's general plant project needs and the Pacific Northwest Laboratory Landlord responsibility (project number 85–R–800).

LIQUIFIED GASEOUS FUELS SPILL TEST FACILITY

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Liquified gaseous fuel spill test facility	3,250	2,000	0	2,000
Total program	3,250	2,000	0	2,000

The goal of the Liquefied Gaseous Fuels Spill Test Facility is to develop the additional safety and environmental control information needed by industry, regulatory agencies, and the general public about accidental release behavior of liquefied natural gas, liquefied petroleum gas, hydrogen, chlorine, and ammonia. This program was established to protect public health and safety as well as the environment from the potentially hazardous effects of these materials should spills occur.

9. POLICY AND MANAGEMENT, ENERGY RESEARCH

The Fiscal Year 1985 budget request for Policy and Management—Energy Research is $530,000. These funds are required to provide for the salaries and related expenses associated with the full-time equivalents in the Office of the Director, Office of Energy Research, and the Office of Management.

This staff provides overall high level management and direction for the Office of Energy Research responsibilities carried out under the following specific programs: High Energy Physics; Nuclear Physics; Biological and Environmental Research; Magnetic Fusion Energy; Basic Energy Sciences; Energy Oversight, Research Analysis and University Support; Multiprogram General Purpose Facilities; and University Research Instrumentation.

In addition to directing the Office's research programs cited above, the Director, Energy Research, also serves as the principal science advisor in formulating basic research policy. In this capacity, the Director provides independent reviews, analyses and recommendations concerning a wide range of activities which require scientific counsel. These activities include, for example, national research and development strategies, plans and policies, including budgetary priorities for energy research and development programs. They also include advising on policy issues regarding the best utilization of the nonweapons multipurpose laboratories assigned to Energy Research for oversight and management. These advisory and oversight responsibilities are carried out through meetings with top management and program officials as necessary throughout the year; interactions with laboratories; presentations to the Energy Research Advisory Board; participation in Congressional hearings; and interactions with the scientific community as a whole.

The Office of Management is responsible to the Director to ensure that Energy Research management structures, procedures, and program planning and budgeting systems are responsive to agency requirements for effective, efficient, and economical achievement of planning goals and program objectives. The staff funded from this program provides the principal managerial direction to all adminstrative, financial, procurement, and construction management oversight activities of the Office of Management.

COMMITTEE ACTION

No change.

D. Geothermal Resources Development Fund

The goal of the Geothermal Resources Development Fund is to reduce the financial risk associated with early geothermal projects so that private sector credit can be made available. Further, the program strives to develop normal borrower-lender relationships which will provide financing of geothermal projects without federal assistance in the future.

The Geothermal Loan Guarantee Program is authorized under the Geothermal Energy Research, Development and Demonstration Act of 1974 (P.L. 93-410), as amended by both the Department of Energy Act of 1978—Civilian Applications (P.L. 95-238) and the Energy Security Act of 1980 (P.L. 96-294).

The Administration's FY 1985 request for managing the fund is $0.121 million.

COMMITTEE ACTION

It is the Committee's understanding that DOE has committed, or is holding in reserve to cover potential commitments, less than $400 million of the $500 million authorized for this activity. DOE, however, has not taken applications for further loan guarantees for over a year. Given the availability of obligational authority, the Committee directs DOE to re-open the Geothermal Loan Guarantee Program to further applications.

E. General Science and Research

1. HIGH ENERGY PHYSICS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Physics research	99,500	107,700	0	107,700
Facility operations	161,000	182,100	0	182,100
High energy technology	82,000	91,800	0	91,800
Subtotal, operating expenses	342,500	381,600	0	381,600
Capital equipment	51,500	65,400	0	65,400
Construction	[1] 86,000	114,000	0	114,000
Total program	480,000	561,000	0	561,000

[1] Does not include reduction of $5M based on a proposed reprogramming from High Energy Physics to Nuclear Physics for the Tandem/AGS Heavy Ion Transfer Line project (84–R–123).

HIGH ENERGY PHYSICS, CONSTRUCTION

[In thousands of dollars]

Project No.	Description	Estimated total cost	Previous appropriation	Fiscal year 1985 DOE request	Authorization
81–E–218	Tevatron I, Fermilab	82,500	54,100	21,300	21,300
82–E–206	Tevatron II, Fermilab	[1] 49,800	37,000	12,000	12,000
84–ER–133	Stanford linear accelerator center linear collider (SLC).	[2] 114,272	32,000	60,500	60,500
85–R–100	Accelerator improvements and modifications, various locations.	10,000	0	10,000	10,000
85–R–101	General plant projects	10,200	0	10,200	10,200
Total				114,000	114,000

[1] Estimated total cost includes $800,000 for PE&D from prior years.
[2] Estimated total cost includes $2,272,000 for PE&D from prior years.

The High Energy Physics program supports basic research which seeks to discover the fundamental constituents of matter and to understand the laws of nature that govern the fundamental behavior of energy and matter. Advancement in high energy physics is dependent on the availability of large, complex particle accelerator and colliding beam facilities, as well as on the sophisticated detectors that record the effects of particle collisions. Progress in the field depends on a continuing interplay of advancements in experiment, theory and technology.

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The experimental work is carried out primarily on the high energy accelerator and colliding beam facilities operated by the DOE. In fiscal year 1985, these will include (1) the 30 GeV (billion electron volts) proton synchrotron, called the Alternating Gradient Synchrotron (AGS) at Brookhaven National Laboratory (BNL); (2) the 1,000 GeV superconducting magnet proton synchrotron at Fermi National Accelerator Laboratory (Fermilab); and (3) the 32 GeV linear electron accelerator at the Stanford Linear Accelerator Center (SLAC). SLAC also has two electron-positron colliding beam facilities for which the linear accelerator acts as the injector: the Stanford Positron-Electron Asymmetric Ring (SPEAR) (4 GeV $\times$ 4 GeV) and the Positron-Electron Project (PEP) (15 GeV $\times$ 15 GeV).

Three new facilities are under construction: the Tevatron I and Tevatron II at Fermilab, and the Stanford Linear Collider (SLC) at SLAC. The Tevatron I and Tevatron II projects comprise the second and third stages of a multi-step development program at Fermilab. Tevatron I permits acceleration of protons and antiprotons to 1,000 GeV and will provide a facility for proton-antiproton collisions at 2,000 GeV. Tevatron II will further expand the accelerator's capabilities by providing upgrading of experimental areas and beam lines external to the main ring for fixed target experiments. The goals of the SLC are (1) to develop and demonstrate the feasibility of using linear colliders to extend electron-positron reaction energies in a cost effective way beyond the maximum that is practical for circular colliders; and (2) to provide the world's earliest access to electron-positron colliding beams of energies of 100 GeV in the center-of-mass. Completion of the SLC on a three-year construction schedule will give the U.S. earliest access to copious production of the recently discovered intermediate vector boson, the Z°.

The fiscal year 1985 budget request for High Energy Physics totals $561.0 million, an increase of $81.0 million above the fiscal year 1984 appropriation of $480.0 million, and includes $381.6 million in operating expenses, $65.4 million in capital equipment, and $114.0 million in construction.

The fiscal year 1985 request for operating expenses is an increase of $39.1 million above the fiscal year 1984 appropriation of $342.5 million. The requested level will (1) permit an overall utilization level of the DOE accelerator facilities at about 55 percent, somewhat above the fiscal year 1984 level; (2) provide continuing support for university- and laboratory-based research groups at these facilities and at facilities in Europe, for non-accelerator experiments, and for theoretical research; (3) continue accelerator R&D at Fermilab and SLAC in support of ongoing construction projects; and (4) provide for preliminary R&D studies for the next generation particle accelerator, the Superconducting Super Collider (SSC).

The fiscal year 1985 request of $65.4 million for capital equipment, an increase of $13.9 million above the fiscal year 1984 appropriation of $51.5 million, will place emphasis on equipment needs at Fermilab and SLAC. The requested funding will support the new secondary beams and detectors required to implement Tevatron II's 1,000-GeV fixed-target program, and for fabrication of detectors for the 1,000 GeV $\times$ 1,000 GeV proton-antiproton colliding beam experiments at the Tevatron I. At SLAC, funding will be provided to upgrade the Mark II detector at PEP for use at the SLC, to up-

grade existing PEP detectors for second-generation experiments, and to work on a second detector for the SLC. University users for non-accelerator experiments and for experiments at the European Large Electron-Positron (LEP) facility will also be supported.

The fiscal year 1985 construction request is for $114.0 million, an increase of $28.0 million over fiscal year FY 1984. A majority of this request, $60.5 million, is to continue construction of the SLC on a rapid schedule. This funding request also provides for the continuation of the Tevatron I ($21.3 million) and the completion of the Tevatron II ($12.0 million) projects at Fermilab, as well as Accelerator Improvement Projects ($10.0 million) and General Plant Projects ($10.2 million), including all of the General Plant Project funding for BNL ($5.7 million).

COMMITTEE VIEW

In July 1983, the Department of Energy's High Energy Physics Advisory Panel (HEPAP) recommended that a Superconducting Super Collider (SSC) be constructed. The SSC, as currently envisioned, would consist of two rings of superconducting magnets in which counter-rotating beams of protons would each be accelerated to 20 trillion electron volts of energy and made to collide at specified intersection regions. The Department of Energy has accepted HEPAP's recommendation and Congress has authorized reprogramming of fiscal year 1984 accelerator research and development funds to initiate an R&D program to investigate key issues associated with the construction of the SSC. One of the activities currently being undertaken is the National Reference Designs Study by the directors of the major U.S. high energy physics laboratories.

The Reference Designs Study addresses three issues: (1) technical feasibility; (2) economic feasibility; and (3) cost demonstration. The Reference Designs Study will furnish an overall cost estimate for SSC construction. It is anticipated that the study will be presented to the Department of Energy in May 1984, with a decision by the Department on whether or not to proceed to the next phase not expected until August 1984. When the Department makes such decision, it shall present its recommendations to this Committee. If the recommendation is made to proceed with the initiation of advanced accelerator research and development and engineering studies aimed at establishing a cost-optimized design for the facility (the Phase I activities), the Department shall also present appropriate funding recommendations to insure timely completion of these activities. However, if the recommendation is made not to proceed with Phase I activities, the Department shall present appropriate reprogramming recommendations that will insure the continuation of the preeminence of this Nation's high energy physics research.

COMMITTEE ACTION

No change.

2. NUCLEAR PHYSICS

[In thousands of dollars]

	Fiscal year—		Committee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Low energy nuclear physics	13,000	13,500	0	13,500
Medium energy nuclear physics	65,000	72,000	0	72,000
Heavy ion nuclear physics	47,000	49,800	0	49,800
Nuclear theory	9,000	9,300	0	9,300
Subtotal, operating expenses	134,000	144,600	0	144,600
Capital equipment	11,300	13,700	0	13,700
Construction	[1] 13,700	25,300	0	25,300
Total program	159,000	183,600	0	183,600

[1] Does not include $5M proposed reprogramming from High Energy Physics for the Tandem/AGS Heavy Ion Transfer Line project (84–R–123).

NUCLEAR PHYSICS, CONSTRUCTION

[In thousands of dollars]

Project No.	Description	Estimated total cost	Previous appropriation	Fiscal year 1985 DOE request	Authorization
84–ER–110	University accelerator upgrade project at University of Washington (Seattle) and Yale University.	19,000	8,000	11,000	11,000
84–R–123	Tandem/AGS heavy ion transfer line, Brookhaven	10,300	[1] 5,000	5,300	5,300
85–R–200	Accelerator improvements and modifications, various locations.	3,500	0	3,500	3,500
85–R–201	General plant projects, various locations	3,500	0	3,500	3,500
85–R–203	Continuous electron beam accelerator facility, Newport News, Va.	([2])	0	2,000	2,000
Total				25,300	25,300

[1] Assumes reprogramming from ISABELLE construction project (78–10–b).
[2] Under review.

The Nuclear Physics program supports experimental and theoretical investigations in order to gain a better understanding of the structure and properties of the atomic nuclei and the forces that govern their behavior. It also seeks to determine how the substructure of protons and neutrons influences the composition and characteristics of nuclei.

Nuclear physics, like high energy physics, makes use of advanced particle accelerator facilities. Seven existing accelerator facilities are operated as national facilities whose beam times are made

available to all the Nation's scientists on the basis of scientific merit and technical feasibility: (1) the Clinton P. Anderson Meson Physics Facility (LAMPF) at Los Alamos National Laboratory (LANL); (2) the William H. Bates Linear Accelerator Center at the Massachusetts Institute of Technology (MIT); (3) the SuperHILAC/ Bevalac at Lawrence Berkeley Laboratory (LBL); (4) the Holifield Heavy Ion Research Facility at Oak Ridge National Laboratory (ORNL); (5) the 88-inch Cyclotron at LBL; (6) the Tandem/Linac Facility at Argonne National Laboratory (ANL); and (7) the Double MP Tandem Van de Graaf facility at Brookhaven National Laboratory (BNL). To complement these national facilities, the program also supports dedicated on-campus accelerators at Yale University, Duke University, the University of Washington, and Texas A&M University.

The fiscal year 1985 request provides for the start of the Continuous Electron Beam Accelerator Facility (CEBAF) construction project (85–R–203) and supporting R&D. CEBAF, expected to be operated by the Southeastern Universities Research Association (SURA), will be capable of delivering intense, high-duty electron beams in the energy range from 0.5 to 4.0 GeV. A new injector at the Stanford Linear Accelerator Center (SLAC) will begin operation and provide high-energy, very-sharply-pulsed electron beams. The Tandem/AGS Heavy Ion Transfer Line construction project (84–R–123) has as its objective the transportation of beams of nuclei as massive as sulfur from the existing Double MP Tandem facility to the Alternating Gradient Synchrotron (AGS) for acceleration to energies of 15 GeV per atomic mass unit. Additional heavy ion capabilities will be provided with the completion of the Argonne Tandem/Linac Accelerator System (ATLAS).

The fiscal year 1985 budget request for Nuclear Physics totals $183.6 million, an increase of $27.6 million above the fiscal year 1984 appropriation of $156.0 million; an additional $3.0 million was provided under Defense Programs for LAMPF facility operations in fiscal year 1984.

This request includes $144.6 million in operating expenses, an increase of $13.6 million above the fiscal year 1984 appropriation of $131.0 million: $73.76 million is requested for the operation of the existing national and dedicated facilities in order for them to achieve 90 percent of the overall levels of utilization experienced in fiscal year 1984; $60.45 million is planned for experimental research, including $5.0 million for R&D in support of the CEBAF project; $1.09 million for operation of the new SLAC injector; and $9.3 million for theoretical research.

The fiscal year 1985 request of $13.7 million for capital equipment, an increase of $2.4 million above the fiscal year 1984 appropriation of $11.3 million, includes $12.9 million for research initiatives at BNL, LBL, ORNL, ANL, LAMPF, and MIT. In addition, the Nuclear Physics program has the responsibility for providing all of LBL's General Purpose Equipment; $800,000 is requested for LBL in fiscal year 1985.

The construction request for fiscal year 1985 of $25.3 million, an increase of $11.6 million above the fiscal year 1984 appropriation, provides for the initiation of the CEBAF construction project ($2.0 million), completion of the construction phase of the Tandem/AGS

Heavy Ion Transfer Line project ($5.3 million), and completion of the University Accelerator Upgrade Project at the University of Washington and Yale University ($11.0 million). Funds are also requested for Accelerator Improvement Projects ($3.5 million), and General Plant Projects ($3.5 million), including all of the General Plant Project funding for LBL ($2.5 million).

COMMITTEE VIEWS

Since LAMPF supplies proton beams, not only for Nuclear Physics research, but also for Defense Programs' and Basic Energy Sciences' activities, proper accounting for LAMPF operations is complicated. In the past, shortfalls in LAMPF operations funding have been corrected by redirecting appropriated funds from Defense Programs. In order to ameliorate the potential LAMPF shortfall in fiscal year 1985, the Committee would encourage the Armed Services and Appropriations Committees, as they have in recent years, to make available additional funds (approximately $3 million) for LAMPF operations from Defense Programs.

The Committee is concerned that although the Nuclear Physics program's fiscal year 1985 request is nearly 15.5 percent above the fiscal year 1984 appropriation, the existing national and dedicated accelerator facilities will achieve only 90 percent of the overall utilization experienced in fiscal year 1984. In addition, new heavy ion capabilities at the Argonne Tandem/Linac Accelerator System (ATLAS) and at Brookhaven National Laboratory, as well as other opportunities elsewhere may be delayed because of inadequate operating funds. The Committee is sympathetic to these difficulties and, consequently, urges that strong consideration be given to making funds available to ameliorate such shortfalls.

COMMITTEE ACTION

The Committee strongly supports the Department's request for funding of the Continuous Electron Beam Accelerator Facility (CEBAF), project 85–R–203. This project is the highest priority of the nuclear physics community, and is essential to maintain this Nation's leadership in nuclear physics. In order that the project may proceed on a timely basis, the Department is directed to expedite the preparation and submission to Congress of a reliable construction schedule and associated cost estimate for the project. Such cost estimate shall include all supporting utilities, roads and grounds, associated facilities, and collateral equipment unique to the special nature of the accelerator building. The sole reason no funding figures are included for fiscal year 1986 and 1987 at the present time is the absence of such an estimate, and this should not be interpreted in any manner as a lack of commitment to this vital project.

In view of the fact that the CEBAF facility is intended to perform experimental research at the frontier of modern science, it is essential that this effort be supplemented by an equally advanced program of theoretical and computational physics. This is true both during and after construction of the facility.

For this purpose, the Department of Energy is directed to establish a state-of-the-art computer facility at a SURA university, with

network access to the University of Virginia, the CEBAF site, and other involved SURA universities. The Committee believes that the existing proposal to the Department from a SURA university to establish such a center would serve as a basis for this activity.

Within available funds a total of $3.0 million is authorized for this purpose, of which $2.0 million is included in the Nuclear Physics program, and $1.0 million in the Applied Mathematical Sciences program.

It is recommended that the computational capability established be closely integrated with the Department's more extensive supercomputer access program. To the extent possible, the facilities of the center can be made available to Department of Energy contractors for scientific and engineering purposes other than Nuclear Physics.

3. GENERAL SCIENCE AND RESEARCH—PROGRAM DIRECTION

The fiscal year 1985 budget request for General Science Program Direction is $2.205 million, a decrease of $45,000 from the fiscal year 1984 appropriation of $2.25 million. These funds provide for the salaries, benefits, travel and other expenses associated with 35 full-time equivalents in the Office of the Associate Director for High Energy and Nuclear Physics, the Division of High Energy Physics, the Division of Nuclear Physics, and associated Energy Research support staff required to administer these programs.

COMMITTEE ACTION

No action.

F. Uranium Enrichment R&D

[In thousands of dollars]

	Fiscal year—		Subcommittee action	
	1984 budget authority (estimate)	1985 DOE request	Changes to DOE request	Total authorization
Operating expenses:				
Gas centrifuge process development	82,900	71,000	[1] +12,000	83,000
Atomic vapor laser isotope separation (AVLIS)	89,000	69,800	[1] +20,000	89,800
Subtotal, operating	172,800	140,800	[1] +32,000	172,800
Capital equipment:				
Gas centrifuge	3,400	1,000	0	1,000
AVLIS	9,500	7,700	0	7,700
Subtotal, capital equipment	12,900	8,700	0	8,700
Construction:				
Gas centrifuge	0	0	0	0
AVLIS, 85-N-501, general plant projects, various locations	3,600	500	0	500
Subtotal, construction	3,600	500	0	500
Total	189,300	150,000	[1] +32,000	182,000

[1] $32 million increase reflects a reduction of $1 million in new budget authority and an increase of $33 million to be obtained from existing unobligated balances.

Uranium Enrichment R&D: Gas Centrifuge Process Development and Demonstration and Atomic Vapor Laser Isotope Separation

The goals of the gas centrifuge process development and demonstration program are to demonstrate the gas centrifuge technology required for the Gas Centrifuge Enrichment Plant, and to develop economic and technical data on advanced gas centrifuges in support of the FY 1985 technology decision. The requested funding provides for the continuation of basic development tasks; continued operation of existing Set V test facilities; and development of materials and processes for improving centrifuge separative performance.

The goal of the Atomic Vapor Laser Isotope Separation (AVLIS) program is to develop a technology which will provide for the production of enriched uranium at significantly reduced cost, and to provide economic and technical data in support of the FY 1985 technology decision. During FY 1985, the AVLIS process will continue to be developed by using the existing small-scale testbeds

such as the SPP II/VENUS laser system and the MARS separator system.

COMMITTEE ACTION

Authorize use of existing budget authority for Advanced Gas Centrifuge (AGC) and AVLIS technology development in the amount of $13 million, and $20-million respectively, to enhance confidence in the 1985 decision on technology deployment. Reduce the FY 1985 request for gas centrifuge process development by $1 million and redirect the funding to lease of computer time rather than purchase of a Class VI computer.

The Committee has authorized a total of $13 million above the Department's request for the Advanced Gas Centrifuge Program. The Committee intends that appropriations be made by reallocating existing budget authority within the uranium enrichment account. The Administration has identified sufficient unobligated balances which it does not intend to use for the purposes originally appropriated, including a significant amount of FY 1984 underruns from electrical costs for diffusion plant operations.

The additional funds provided by the Committee may appropriately be allocated in the following manner:

1. Goodyear contract: $2 million to improve Set V rotor design for 5-stream operations, to increase productivity of the machine, to improve balancing methods, and to test full-scale machines.
2. Boeing contract: $5 million to incorporate Set V rotor design details into procurement specification format, to make additional demonstration runs on advanced suspension units, to procure and fabricate specific advanced materials into prototype hardware, and to test full-scale machines.
3. Garrett contract: $4 million for advanced suspension and high speed rotor development, and to test full-scale machines.
4. Union Carbide contract: $2 million to procure and manufacture backup hardware, to respond to technical contingencies evidenced by operation of the intermediate speed machines, and to test full-scale machines.

The additional $20 million for AVLIS will allow the program performers to achieve or exceed the demonstration milestones prior to process selection by providing data which would be keyed to an earlier technology deployment.

COMMITTEE VIEW

Uranium Enrichment R&D Program

The DOE's decision to select an advanced enrichment technology by mid-1985 for deployment in the late 1980s will be a challenging task because neither the Advanced Gas Centrifuge (AGC) program nor the Atomic Vapor Laser Isotope Separation (AVLIS) program will have developed a sufficiently detailed data base by then to provide significant technical and economic confidence. The AGC program will not have operated a complete production-qualified, full-scale Set V machine at full speed or collected any operating lifetime data on such a machine. The AVLIS process will not have had

a full-scale demonstration in terms of either operation of a full plant pod or process lasers at the power level required for the complete plant operation and maintenance cycle. Both of these integrated technology demonstrations were scheduled for 1987. This absence of detailed technical and economic data places an increased burden on the quality of technical review required for process selection under the Department's accelerated schedule. The Committee believes that the DOE should conduct a review whereby the AGC community has full access to and critiques the AVLIS work, and the AVLIS community has full access to the AGC work and critiques that effort. These critiques and responses should be provided to a technically sophisticated, objective review group which is charged with rendering a recommendation to be incorporated in the Department's selection process. The review process should be aimed at resolving the major issues: technical, cost and schedule, to within a reasonably narrow range of uncertainty.

The Committee also intends that the "losing technology" as a result of an FY 1985 process selection nevertheless be funded at a healthy level in FY 1986, such that the program risks of advanced technology development versus potential economic pay-off remain balanced. Such a level of effort should allow for a capability to accelerate technology development toward demonstration and deployment as a production technology, if and when that is warranted. This funding should allow for more than a minimal effort and recognize the need to conduct critical R&D activities within the contractor organizations.

Independent of which technology is selected, and as part of its cost estimating activities, the DOE should conduct an evaluation of the existing diffusion plant sites for the purposes of locating the first AVLIS production plant and provide the results of this site evaluation to the Committee prior to submission of the FY 1986 budget request.

V. RESEARCH AND DEVELOPMENT—FISCAL YEARS 1986 AND 1987

SUMMARY OF COMMITTEE ACTIONS

[In thousands of dollars]

	Fiscal year—			
	1985 DOE request	1985 committee action	1986 committee action	1987 committee action
Fossil energy:				
Operating and capital equipment			345,500	357,000
Construction			3,000	3,500
Total	272,870	324,045	348,500	360,500
Energy conservation:				
Operating and capital equipment			166,100	159,100
Construction			2,700	0
Total	130,398	149,748	168,800	159,100
Energy supply R&D:				
Solar energy:				
Operating and capital equipment			192,800	202,700
Construction			9,000	0
Total	157,149	190,485	201,800	202,700
Geothermal energy:				
Operating and capital equipment			34,700	32,400
Construction			0	0
Total	27,087	32,587	34,700	32,400
Nuclear fission:				
Operating and capital equipment			452,735	410,585
Construction			52,600	82,300
Total	459,056	487,747	505,335	492,885
Magnetic fusion energy:				
Operating and capital equipment			466,000	495,000
Construction			51,000	53,000
Total	483,138	492,338	517,000	548,000
Electric energy systems and energy storage systems:				
Operating and capital equipment, total	35,335	40,000	49,000	45,300
Supporting research and technical analysis:				
Operating and capital equipment			439,300	483,900
Construction			79,500	68,160
Total	479,580	479,350	518,800	552,060
Environmental R&D:				
Operating and capital equipment			257,460	270,342
Construction			3,150	3,300

	Fiscal year—			
	1985 DOE request	1985 committee action	1986 committee action	1987 committee action
Total	228,204	243,754	260,610	273,642
Policy and management, energy research: Operating expenses, total	530	530	557	585
Subtotal, energy supply R&D	1,870,079	1,966,791	2,087,802	2,147,572
Geothermal resources development fund (GRDF): Operating expenses, total	121	121	121	121
General science and research:				
Operating and capital equipment			701,100	782,300
Construction			57,500	34,800
Total	746,805	746,805	758,600	817,100
Uranium enrichment R&D:				
Operating and capital equipment			170,000	170,000
Construction			0	0
Total	150,000	[1] 182,000	170,000	170,000
Total, title II	3,170,273	[1] 3,369,510	3,533,823	3,654,393

[1] $32 million increase in fiscal year 1985 for Uranium Enrichment R&D is the net action of a reduction of $1 million in new budget authority and an increase of $33 million which is to be provided from existing unobligated balances in the Uranium Enrichment account and not from new budget authority.

CONSTRUCTION PROJECTS—FISCAL YEARS 1986 AND 1987

	1986	1987
Fossil energy	$3,000,000	$3,500,000
Energy conservation: 84–CS–101	2,700,000	
Solar energy: 84–CE–001, phase III Sacramento Municipal Utility District, photovoltaics plant, 5MW	9,000,000	
Basic energy sciences:		
86–ER–400, general plant projects	6,300,000	
87–R–400, general plant projects		7,000,000
86–ER–401, accelerator improvements and modifications, various locations	2,600,000	
87–R–401, accelerator improvements and modifications, various locations		2,900,000
85–ER–403, ion collision facility, Kansas State University	1,400,000	
85–ER–402, Standford Synchrotron Radiation Laboratory enhancement, Stanford Linear Accelerator Center	2,560,000	
84–ER–112, Center for Advanced Materials, Lawrence Berkeley Laboratory	14,440,000	13,260,000
84–ER–111, beam lines and support area construction, National Synchrotron Light Source, Brookhaven National Laboratory	7,200,000	
Subtotal, basic energy sciences	34,500,000	23,160,000
Multiprogram general purpose facilities:		
84–ER–103, road repair, Richland, Lawrence Berkeley, Idaho and Argonne National Labs	8,500,000	
85–R–701, central chilled water facility, Brookhaven National Laboratory	7,500,000	4,000,000
85–R–702, replace laboratory roofs, Argonne National Laboratory	3,300,000	2,992,000
85–R–703, electrical distribution system restoration, Oak Ridge National Laboratory	1,100,000	
85–R–706, medical facility replacement, Lawrence Livermore National Laboratory	5,700,000	
85–R–707, replace site fire alarm, Richland Operations	3,550,000	
85–R–709, central chilled water plant, Argonne National Laboratory	4,200,000	
85–R–711, upgrade environmental monitoring systems, Oak Ridge National Laboratory	2,500,000	
85–R–712, modify central chilled water plant, Oak Ridge National Laboratory	3,700,000	
Unspecified general purpose facilities	4,950,000	38,008,000
Subtotal, multiprogram general purpose facilities	45,000,000	45,000,000

	1986	1987
Nuclear fission:		
Converter reactor systems: 86–N–605, modular high temperature gas-cooled reactor (MHTGR) test reactor, site undetermined	25,000	50,000
Breeder reactor systems:		
85–N–602, ANL–West physical security upgrades, Argonne National Laboratory, INEL, Idaho	900	600
85–N–604, modification to the fuels and materials examination facilities (FMEF) for the breeder reprocessing engineering test (BRET), Richland, Wash	20,000	25,000
86–N–600 and 87–N–600, general plant projects, breeder reactor systems	5,700	5,700
86–N–601 and 87–N–601, modifications to reactors, various locations	1,000	1,000
Total, nuclear fission	52,600	82,300
Magnetic fusion:		
78–3–b, fusion materials irradiation test facility, Richland, Wash	10,000	8,000
78–3–a, mirror fusion test facility–B, Lawrence Livermore National Laboratory, Livermore, Calif	9,042	0
86–R–300 and 87–R–300, general plant projects, magnetic fusion energy	4,958	5,000
86–N–301, Tokamak fusion core experiment, site undetermined	27,000	40,000
Total, magnetic fusion	51,000	53,000
High energy physics:		
81–E–218, Tevatron I, Fermilab	7,100,000	.....
84–ER–133, Stanford linear accelerator center linear collider (SLC)	19,500,000	.....
86–R–100, accelerator improvements and modifications, various locations	11,500,000	.....
87–R–100, accelerator improvements and modifications, various locations	.....	12,800,000
86–R–101, general plant projects	11,700,000	.....
87–R–101, general plant projects	.....	13,500,000
Subtotal, high energy physics	49,800,000	26,300,000
Nuclear physics:		
86–R–200, accelerator improvements and modifications, various locations	3,900,000	.....
87–R–200, accelerator improvements and modifications, various locations	.....	4,200,000
86–R–201, general plant projects	3,800,000	.....
87–R–201, general plant projects	.....	4,300,000
Subtotal, nuclear physics	7,700,000	8,500,000
Total, general science and research	57,500,000	34,800,000

COMMITTEE ACTION

The Committee has recommended authorizations for fiscal years 1986 and 1987, as well as for fiscal year 1985. These authorizations assume current programs continuing through the period, and no significant new starts.

Where changes were made from the Department's request for a particular program for fiscal year 1985, the resulting change was included in future years to arrive at the out-year authorizations. It is assumed that projects considered and approved in previous years, as well as projects approved in fiscal year 1985, will be continued within the funding proposed for fiscal years 1986 and 1987. Two exceptions are noted: (1) the Continuous Electron Beam Accelerator Facility (CEBAF) construction project, 85–R–203, for which no out-year funding or construction schedule currently exists; and (2) the Superconducting Super Collider Phase I R&D effort, which has not yet been approved by DOE. These activities are included only at 1985 base R&D levels plus inflation.

Additional authorization for these items and new starts that may be added in out-year budgets will be considered as amendments to the basic authorization.

In Fossil Energy some allowance is made for an expanded program or larger scale testing in areas such as coal preparation, coal-fired heat engines, pressurized fluidized beds, and MHD.

In Energy Conservation, allowances were made to increase ECUT levels to those requested in fiscal year 1985, and for increased scale in several industrial projects, and several buildings research areas, and to complete the Stirling (MOD II) and gas turbine engine projects.

In Solar Energy, no funds were included for the construction of a permanent SERI lab facility, and phase III of the SMUD photovoltaics facility is completed in fiscal year 1986.

Geothermal Energy authorizations assume a gradual decrease in hot dry rock and geopressured resources.

In Nuclear Fission, the Committee recommends the following:

	Fiscal year—		
	1985	1986	1987
Converter reactor systems	$116,725	$167,050	$151,600
Nuclear waste treatment technology	6,300	7,000	7,100
Civilian radioactive waste R&D	27,640	23,500	21,100
Advanced nuclear systems	38,500	51,900	61,800
Breeder reactor systems	293,582	248,385	242,285
University program	5,000	7,500	9,000
Total	487,747	505,335	492,885

Out-year funding for Converter Reactor Systems maintains the FY 1985 Committee initiatives and provides for the initiation of a construction project line item in FY 1986: Project numbered 86-N-605, Modular High Temperature Gas-Cooled Reactor (MHTGR) test reactor, site undetermined, funded at $25,000,000 in FY 1986, and at $50,000,000 in FY 1987. The funding recommendations also reflect increased activities relative to supporting R&D for the modular HTGR, advanced LWR designs, and LWR safety with additional funding provided from termination of LOFT funding requirements.

Out-year funding for Advanced Nuclear Systems reflects expansion of RTG work in the Space and Special Applications subprogram and assumes an FY 1985 decision to enter into the ground engineering systems development phase for the Space Nuclear Reactor, with significant funding growth for the SP-100 program.

For Breeder Reactor Systems, out-year funding reflects the Committee initiatives begun in FY 1985 including reduced test facility costs due to further consolidation of facility operations. The Committee recommendations also include the initiation of a construction project line item: Project numbered 85-N-604, Modification to the fuels and materials examination facilities (FMEF) for the Breeder Reprocessing Engineering Text (BRET), Richland, Washington, funded at $20,000,000 in FY 1986, and at $25,000,000 in FY 1987. The out-year funding assumes termination of the WCBR activities and utilization of breeder test facilities and personnel to

support Advanced Converter and SP-100 programs in the framework of the Committee's Advanced Reactors R&D program.

Nuclear Waste Treatment Technology and Civilian Radioactive Waste R&D are maintained at a level consistent with a continued program for the activities described in FY 1985 budget request.

The University Program is maintained at modest growth levels in the out-years to account for inflation.

In Magnetic Fusion Energy, the Committee recommends a 5% increase for inflation and increased funding to provide for the build-up of the Tokamak Fusion Core Experiment (TFCX). The TFCX will be funded in a construction line item beginning in FY 1986, Project numbered 86-R-301, at $27,000,000 in FY 1986, and at $40,000,000 in FY 1987. Out-year funding also reflects the completion of the MFTF-B project at the end of FY 1986.

In Electric Energy Systems and Storage, out-year funding is provided to maintain base levels of activity and program continuity, with additional funds provided for the Hawaii Deep Water Cable program in the amounts of $7,000,000 in FY 1986 and $1,300,000 in FY 1987.

In Supporting Research and Technical Analysis, the authorization levels allow Basic Energy Sciences (BES) program operating expenses, accelerator improvement and reactor modification projects (AIP) and general plant projects (GPP) funding to increase 10 percent annually; BES capital equipment to increase 15 percent annually; and all other Supporting Research and Technical Analysis program operating expenses and the Multiprogram General Purpose Facilities program to assume the levels of the Department of Energy's projections for fiscal years 1986 and 1987. The allowances for BES operating expenses and capital equipment are below the fiscal year 1981-1985 annual average increases of 13.6 percent and 21 percent, respectively.

In Environmental R&D, the Committee recommended that the Environmental, Safety and Health programs be funded at a level of $35,280,000 for FY 1986 and $37,044,000 for FY 1987. This reflects a six percent increase in FY 1986 over FY 1985 authorization and a six percent increase in FY 1987 over FY 1986 levels. The Committee concluded that the increases should be sufficient to accommodate program growth.

The Committee recommended that the Biological and Environmental programs be funded at a level of $210,105,000 for FY 1986 and $220,610,000 for FY 1987. This reflects a seven percent increase in FY 1986 over the FY 1985 authorization level and a five percent increase in FY 1987 over the FY 1986 levels. The Committee expressed concern that a five percent increase in some program elements might not be adequate but that for the overall program, the increases were sufficient to maintain the research efforts.

The Committee recommended that the liquified spill test facility program be funded at a level of $2,100,000 for FY 1986 and $2,205,000 for FY 1987. This reflects a five percent increase in FY 1986 over the FY 1985 authorization level and a five percent increase in FY 1987 over the 1986 levels.

The Committee recommended that capital equipment and construction be funded at a level that reflects of five percent increase above FY 1985 for FY 1986 and at a level of five percent increase

above FY 1986 for FY 1987. The totals for all environmental programs are: capital equipment, $9,975,000 in FY 1986 and $10,474,000 in FY 1987; and construction, $3,150,000 in FY 1986 and $3,301,000 in FY 1987.

In Policy and Management, Energy Research, the Committee recommends a 5% per year increase for FY 1986 and FY 1987 from the Department's FY 1985 request of $530,000.

In General Science and Research, the authorization levels allow High Energy and Nuclear Physics programs operating expenses and capital equipment annual increases of 10 percent per year; accelerator improvement projects (AIP) and general plant projects (GPP) funding to increase about 15 percent annually; and completion of all construction projects considered and approved in previous years, as well as projects approved in fiscal year 1985, with the exception of the CEBAF project as noted above. Also included in the allowances are incremental operating expenses and capital equipment funding for SLAC and Fermilab, the AGS Tandem project at BNL, and the University Accelerator Upgrade project at Yale University and the University of Washington, as well as special detector needs to allow optimum utilization of the SLC, and the Tevatron I and II. Also, as noted above, the fiscal year 1986 and 1987 authorizations include SSC Phase I R&D activities only at the 1985 R&D levels plus 10 percent per annum.

In Uranium Enrichment R&D, the Committee has provided contingency funding in FY 1986 so that the process selected in FY 1985 can be funded at an optimum level with at least $40–50 million available to support the "losing technology." Any excess funding available beyond these requirements could be transferred to support Advanced Converter and SP–100 R&D activities and thus preserve a balanced Advanced Reactors program.

VI. EFFECT OF LEGISLATION ON INFLATION

In accordance with Rule XI, clause 2(1)(4), of the Rules of the House of Representatives, the following is a statement concerning the inflationary impact of H.R. 5244.

H.R. 5244 is assessed to have no significant inflationary effect on prices and costs in the operation of the national economy.

VII. COMMITTEE OVERSIGHT FINDINGS AND RECOMMENDATIONS

Pursuant to Rule XI, Clause 2(1)(3), of the Rules of the House of Representatives, and under the authority of Rule X, Clause 2(b)(1) and Clause 3(f), the results and findings from the Committee's oversight activities are incorporated in the recommendations found in the present bill and report.

VIII. SUMMARY OF GOVERNMENT OPERATIONS COMMITTEE FINDINGS AND RECOMMENDATIONS

No findings and recommendations on oversight activity pursuant to Rule X, Clause 2(b)(2), and Rule XI, Clause 2(1)(3), of the Rules of the House of Representatives, have been submitted by the Committee on Government Operations for inclusion in this report.

IX. BUDGET ANALYSIS AND PROJECTION— CONGRESSIONAL BUDGET ACT INFORMATION

This bill provides for new authorization rather than new budget authority and consequently the provisions of section 308(a) of the Congressional Budget Act of 1974 are not applicable.

X. CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

1. Bill number: H.R. 5244.

2. Bill title: Department of Energy Civilian Research and Development Act for Fiscal Years 1985, 1986, and 1987.

3. Bill status: As ordered reported by the House Committee on Science and Technology, April 3, 1984.

4. Bill purpose: The bill authorizes $3,370 million in 1985, $3,534 million in 1986, and $3,654 million in 1987 for civilian research and development programs of the Department of Energy (DOE). The authorization includes funds for research in solar, fossil, nuclear, and other energy technologies.

5. Estimated cost to the Federal Government:

[By fiscal years, in millions of dollars]

	1985	1986	1987	1988	1989
Authorization level	3,370	3,534	3,654	.....	.....
Estimated outlays	1,717	2,990	3,561	1,802	480

The costs of this bill fall within budget functions 250 and 270

Basis of estimate: CBO assumes that all amounts authorized will be appropriated and that spending will occur at historical rates

6. Estimated cost to State and local governments: None.

7. Estimate comparison: None.

8. Previous CBO estimate: On April 6, 1984, the Congressional Budget Office prepared a cost estimate for H.R. 5245, which also authorizes funding for DOE programs. The amounts in Titles I and II of that bill are equal to the amounts authorized by H.R. 5244.

9. Estimate prepared by: Jeff Nitta and Kathy Gramp.

10. Estimate approved by: C. G. Nuckols, for James L. Blum, Assistant Director for Budget Analysis.

XI. CHANGES IN EXISTING LAW MADE BY THE BILL AS REPORTED

In Compliance with Rule XIII, clause 3 of the Rules of the House of Representatives, there are no changes in existing law made by the bill, as reported.

XII. COMMITTEE RECOMMENDATION

A quorum being present, the bill (H.R. 5244) was ordered reported on April 3, 1984 by the Committee by a roll call vote of 26–14.

ADDITIONAL VIEWS ON DOE FY 1985–1987 AUTHORIZATION (H.R. 5244)

With forecasted deficits approaching $200 billion, it becomes important to examine carefully all spending bills, but especially discretionary, non-defense bills such as this one. Republicans and Democrats alike have been diligently searching for ways to reduce this deficit with minimum impacts on their constituents. How then can we justify the expenditure of $17.5 million for the refinement of a 19th Century technology engine for automobiles which the U.S. automobile industry has expressed little or no interest in? We don't deny that Mechanical Technology, Inc. has done an outstanding job with the Sterling engine, but the fact remains that if this were indeed a worthwhile concept, private industry would and should pursue it on their own. We simply must protest this irresponsible use of public funds.

HERBERT H. BATEMAN.
ROD CHANDLER.
F. JAMES SENSENBRENNER, Jr.
RAYMOND J. MCGRATH.
BILL LOWERY.
MANUEL LUJAN, Jr.
WILLIAM CARNEY.
ROBERT S. WALKER.
LARRY WINN, Jr.
JOE SKEEN.
ALFRED A. MCCANDLESS.
JUDD GREGG.

ADDITIONAL VIEWS OF MR. OTTINGER, MR. GLICKMAN, MR. BROWN, MR. MINETA, AND MR. HARKIN

During markup of H.R. 5244 in Full Committee, we proposed an amendment to transfer $23.5 million from nuclear fuel reprocessing activities to research and development in certain areas of the Energy Conservation and Solar Energy budgets. The net impact on the overall funding level contained in the bill was zero. Although the amendment was not accepted at that time, we expect to raise this issue again on the floor in order to give Congress the opportunity to strike a more reasonable balance among our energy priorities without adding to the Committee's total spending level.

In particular, we disagree with the Committee's support of $35.4 million in the Nuclear Fuel Cycle subprogram of Breeder Reactor Systems—a 200 percent increase over the $11.9 million request of the Administration—while recommending only minor increases for conservation and solar research and development.

The Administration's $11.9 million request for nuclear reprocessing activities is sufficient to complete the proof-of-breeding experiment, and to develop remotely operated and maintained reprocessing systems using technologies that would be applicable to any future advanced breeder reactor. However, the Subcommittee on Energy Research and Production added $20 million to the Administration's request for reprocessing activities which DOE itself seeks to terminate, including the breeder reprocessing engineering test (BRET). The Subcommittee also added $3.5 million for the High Temperature Reactor fuel cycle or dry process evaluation. This additional spending is unnecessary in view of the substantial funding for High Temperature Gas Reactors elsewhere in the bill, and in view of the current abundance of domestic uranium at one-half to one-quarter the anticipated price of processed fuel.

Meanwhile, critical research on technologies to improve energy efficiency in buildings, industry, and transportation remains severely underfunded. Buildings use over one-third of U.S. primary energy. DOE recently reported that most studies agree savings in the range of 30–50 percent are possible in this sector by the year 2000. Similar savings are possible in the industrial sector, which consumes roughly 37 percent of the nation's energy. Yet research in these areas has been cut by 60 percent since 1981.

Research on vehicle and engine research and development has also lagged, declining by 50 percent since 1981, despite the fact that progress in the transportation sector has the most direct impact on imported oil of any of our research efforts.

Accordingly, we are recommending transferring $23.5 million from nuclear fuel reprocessing conservation and solar research as follows:

—$7.675 million to Energy Conservation research and development on Buildings and Community Systems.

—$9.650 million to Energy Conservation research and development on Industrial technology.
—$1.175 million to Energy Conservation research and development on Transportation technology.
—$5.0 million to Solar Buildings Energy Research.

We wish to stress that these funding levels are consistent with the levels recommended by DOE in its 5-Year Energy Conservation Technology R&D Program Plan. This Plan is an extensive analysis of energy conservation research needs in the light of ongoing private sector research and federal budget constraints. It reflects DOE's wide consultations with private research organizations, interest groups, and DOE's own program managers. Most of all, the Plan recognizes the nation's critical need to accelerate basic research in those areas which contribute most directly to a renewable energy future at a reasonable cost.

When DOE funding levels are debated before the House we will urge our colleagues to join with us in a critical examination and reorientation of current energy priorities.

RICHARD L. OTTINGER.
TOM HARKIN.
GEORGE E. BROWN, Jr.
DAN GLICKMAN.
NORMAN MINETA.

ADDITIONAL VIEWS OF THE HONORABLE RICHARD L. OTTINGER ON ENERGY PRIORITIES NEED REDIRECTION

Earlier this year the President proposed an energy budget for fiscal year 1985 that essentially continues along a path begun in 1981, emphasizing spending on nuclear fission and fusion, while proceeding at reduced levels for other energy programs, particularly conservation, solar and renewables, and fossil energy. Although the President's budget, to some degree, reflects the appropriations in fiscal year 1984, these appropriations in turn reflect the severe reductions in conservation, solar and fossil that have occurred since the President took office, and the continued level spending in nuclear. The President's fiscal year 1985 budget request would spend twice as much on nuclear fission and fusion than on combined spending for conservation, solar and fossil energy. In addition, the President would require most of the conservation spending to come from oil overcharge accounts, rather than from general revenues.

With reductions of this nature it might be assumed that the total Department of Energy budget would be reduced, but, in fact, the President has proposed the largest budget ever requested for the Department. The reason for the increase? Nuclear weapons production.

Although civilian energy programs (excluding the Strategic Petroleum Reserve) would be reduced by about $1.4 billion compared to 1982, the DOE Atomic Defense Programs would be increased by $4.2 billion compared to 1981. This represents a funding level for weapons more than double that in 1981. Thus, all savings in energy programs have been transferred to the weapons programs.

The Science and Technology Committee, while not having jurisdiction over defense programs, nonetheless had a prime opportunity to redirect spending priorities to those energy technologies which would provide the greatest return on taxpayer investment. I offered a number of amendments in subcommittee and full committee markup to achieve a more balanced and productive energy program; however, none were accepted.

The Committee increased solar and conservation programs somewhat from the President's request, but spending levels remained far below the FY 1981 amounts. Congressman Glickman and I offered an amendment in full committee to boost innovative research in the solar, alcohol fuels and conservation area by reducing the subcommittee add-on in nuclear fuel reprocessing to the level requested by the President. If the amendment had passed, the net budgeteary impact on the bill would be zero and these important renewable and conservation programs would have been funded.

The amendment would have reduced Nuclear Fuel Cycle funds to the $11.9 million level requested by the Administration. The Administration's request includes funds to complete the proof-of-

breeding experiment, and to develop remotely operated and maintained reprocessing systems that would be applicable to any future advanced breeder reactor. However, the amendment eliminated $20 million added in subcommittee for activities that DOE itself wishes to terminate, such as the breeder reprocessing engineering test (BRET). The amendment also struck $3.5 million added in subcommittee for the High Temperature Reactor fuel cycle or dry process evaluation. DOE did not request and does not need these additional funds in view of the substantial funding for High Temperature Gas Reactors elsewhere in the bill and in view of the current abundance of domestic uranium at one-half to one-quarter the anticipated price of processed fuel.

Our amendment would have distributed the $23.5 million to research and development in buildings and community systems, industrial technology and transportation technology programs in energy conservation research and research in solar building technology.

Our amendment would have directed support to these research efforts both because they have been cut so severely (over 50 percent since 1981), and because these levels are consistent with the levels recommended by DOE in its 5-Year Energy Conservation Technology R&D Program Plan. This Plan is an extensive analysis of energy conservation research needs in the light of ongoing private sector research and federal budget constraints. It reflects DOE's wide consultations with private research organizations, interest groups, and DOE's own program managers. Most of all, the Plan recognizes the nation's critical need to accelerate basic research in those areas which contribute most directly to a renewable energy future at a reasonable cost.

While the amendment attracted strong support in the Committee it did not pass.

I also offered an amendment to transfer $6 million from the nuclear fuel reprocessing program into the extended burnup nuclear fuel program so that the enormous benefits of this demonstration project could be fully developed.

The Science and Technology Committee has consistently supported this worthwhile program, which is aimed at increasing the energy efficiency of nuclear fuel by 40 percent. In past years this support has included the full participation of all 5 U.S. nuclear fuel vendors. However, this year only $6 million was supported by the Committee when $12 million will be needed. $6 million spread among 5 vendors will not be sufficient to continue the full program. At this level of funding, only 3 vendors would likely be left in the program and only about one-half of the burnup extensions would be achieved. Industry witnesses have testified and DOE officials have confirmed that $12 million will be needed in FY 1985 to continue full participation of all 5 vendors.

There is no dispute over the many additional benefits other than increased efficiency that would come from the Extended Burnup program. These benefits include:

A reduction of 40 percent in the generation of radioactive wastes (in the form of spent fuel) from these powerplants;

A reduction of 15 percent in uranium resources needed for fuel; and

A cumulative economic savings to consumers and ratepayers of up to $13 billion by the year 2000, according to GAO.

Unfortunately, because full funding was not supported by the Committee, the enormous benefits of this program may well be jeopardized.

I offered two amendments to major nuclear energy programs aimed at focusing attention on the unjustified imbalance in energy priorities toward this costly technology. If these amendments had passed, they would have saved taxpayers $336 million. These cuts are entirely justified in light of the ever-expanding federal deficits and the uneconomic and far off prospects of the nuclear programs I proposed cutting.

The first amendment was to cut the base breeder program from more than $226 million to $85 million.

The amendment I offered provided a level of funding for this program which would truly reflect the role of breeder technology in our energy future and its economic prospects. In my view the Committee has lost sight of the economic context in which the breeder would become commercial and has not paid sufficient regard to the economic and technologic development of nuclear energy over the past decade.

The objective of the DOE Liquid Metal Fast Breeder Reactor (LMFBR) program is to provide a long-term nuclear fission option that would be available if economic uranium resources become insufficient to support the use of converter reactors.

Early forecasts (mid-1960) of high nuclear growth combined with low uranium resource estimates, suggested that breeder reactors would become economic by the mid-1990's. As a result, a program which included the near term operation of a breeder demonstration plant, the Clinch River Breeder Reactor (CRBR) was begun in the early 1970's. However, dramatic declines in nuclear demand forecasts over the past 12 years, combined with significant increases in the size of economically recoverable uranium resources now clearly indicate that the introduction of any breeder technology, including the construction of a new breeder demonstration plant, will not be necessary. Moreover, when based on present capital cost estimates for large LMFBR plants, it is now evident that breeder reactors would not become economically competitive with existing converter reactors until uranium prices, currently less than $20 per pound, rise to at least $175 per pound or more. Because current uranium resource estimates greatly exceed all forecasts for nuclear power growth, uranium price increases that would result from dwindling resources are not expected until the year 2050 and probably later. Thus, uranium utilization in converter reactors will likely remain the most economic form of fission-generated electricity for the next 70 or more years. For that reason and under these changed circumstances I do not believe the Committee can justify funding this program at the level of prior years.

In addition, important improvements are being made in uranium enrichment and nuclear fuel burnup. Advanced uranium enrichment methods are now being developed which could increase by approximately 20 percent the amount of fissionable U-235 from each batch of natural uranium than would occur under presently used technology. Moreover, the reduced uranium requirements resulting

from improvements to existing and future reactors could extend economic uranium by 25–40 percent or more. These uranium efficiency improvements are independent of each other; together, they could act to expand by one-half the current base of the economically recoverable resource (at $100 per pound or less).

Under these circumstances, proposals to provide substantial funds to long-term fission options for possible use beyond the period when converter reactors are no longer economic must be carefully examined.

In my view the Committee should undertake such an examination promptly. In 1983, Congress terminated support for the Clinch River Breeder Reactor (CRBR) project. In addition to the many project-specific cost concerns with CRBR, serious questions also arose about not only the plant's design, but the overall approach to breeder reactor development. These concerns centered around three principal problems: (1) unresolved questions about safety, including the relative safety of pool versus loop breeder reactor designs; (2) high capital costs of the present DOE breeder design and its associated fuel cycle and the questionable economic prospects for this particular design; and (3) serious questions about the proliferation resistance of the present breeder design and about plutonium-based, nuclear power technology in general. Although these questions were viewed with different levels of concern they represent the fundamental concerns which any future DOE breeder program must address.

Thus, safety, economic competitiveness and proliferation resistance provide three meaningful and broadly applicable criteria against which all breeder reactor concepts should be measured.

My amendment authorized funds for advanced plant concept development, for international breeder collaboration and to prove the performance of current and advanced fuels and materials in conjunction with tests in the Fast Flux Facility (FFTF). I believe the development of advanced fuels and materials and the operation of existing test facilities such as the Fast Flux Test Facility (FFTF) that are associated with this development should continue while opportunities for international cooperation in breeder research and development are pursued. A vigorous evaluation of alternative breeder reactor concepts, responsive to the criteria of improved safety, economics and proliferation resistance should also be pursued. However, major resource commitments to particular concepts would be highly premature. The Department's request for FY 1985 was not consistent with this approach and would have perpetuated large capital outlays to existing program and facilities.

My second amendment would cut the magnetic fusion program from almost $495 million to $300 million.

In 1981, fusion received $394 million which represented 10 percent of the DOE budget. By 1984 the fusion budget had increased to nearly half-a-billion dollars—$470 million—representing almost 20 percent of the budget. DOE has again increased its request for this program to $483 million, or 21 percent of the total budget and the Committee has added even more money to the program. To put it in perspective, the Committee fusion funding level is only $123 million less than DOE's request for all fission programs except waste and management.

DOE's stated funding policies which require high risk and high costs have omitted a crucial criterion which is eventual pay-off in a reasonable time. Although there have been advances in the fusion program, and many more will be achieved, this program is functioning like a platinum-plated shotgun going off in many directions at once. DOE is pursuing a number of different and extremely expensive development options.

The Committee authorization does not direct DOE's activities in the fusion program, it simply sets an overall figure. The Department could put funds into each of the various technologies, or it could select one technology for development, as it will do in the uranium enrichment program. The enrichment program is quite similar to the fusion program. Enrichment has been developing two technologies, both with substantial and near-term pay off. However, due to budget constraints it can no longer continue to develop both to demonstration, and must choose between the two in the next year. The same rigorous technology evaluation that was applied in the advanced isotope separation decision in 1981 and that will be applied in 1985 can be equally well used in the fusion program, with substantial benefits to the taxpayers. My amendment would force DOE to make those tough decisions so that we do not just keep pouring millions and millions of dollars into this project.

All of the amendments I offered were unsuccessful. Yet, they all presented clear options for national energy policy spending and direction. In addition, these amendments would have provided significant savings and budget reductions to the Federal Treasury. The Committee has made its recommendation on the direction our energy research efforts should go. Now it is up to the House to support or change that direction. I plan to offer these amendments when the bill comes to the Floor so that the Congress has a range of policy options.

The Committee recommended significant support for advanced converter reactors which have a number of potential advantages. Among them are inherent safety, small or modular designs and a modular high temperature gas reactor (HTGR). While I did not offer an amendment in this area, I have a number of concerns and reservations about the Committee's actions.

The concept of Inherently Safe Reactors is superficially very appealing, but has not been fully examined by the Congress. Key questions which have not been answered include:

—Does the Nuclear Regulatory Commission believe that reactors which are inherently safe can actually be designed and built?

—How is the concept of inherently safe reconciled with the new Probablistic Risk Assessment approach to safety pioneered by Professor Rasmussen of MIT and which is finding increasing acceptance as a basis for safety judgments and regulatory decisions?

Until these questions have been fully and satisfactorily examined it would appear premature to launch any efforts (beyond a purely exploratory study) on inherently safe reactors. The DOE request of $1 million appears appropriate for exploratory work, but the Committee would go far beyond that, by authorizing experimental and analytical development work.

In addition, the concept of small reactors appears to have merit, but has not been fully examined by the Congress. Key questions which have not been examined include:

—What are the lessons that have been learned from present reactors which have been developed through a process of scale-up where many small reactors were built and operated for many years. Can these lessons be applied without committing to a costly development project that may just be reinventing the wheel?

—An important safety concern historically has been the increased risk to the public as larger numbers of reactors are built, even though each reactor is no less safe than earlier ones. If the country needs a certain amount of electrical capacity, and it is determined that this capacity should be supplied by nuclear power, are fewer, larger facilities preferable to more numerous, smaller facilities?

—The siting and licensing of nuclear reactors justifiably consumes a great deal of time and resources and has borne no relationship to reactor size. Would it be preferable for this reason to build fewer and larger reactors?

Until these questions have been fully and satisfactorily examined, it seems premature to launch major development efforts on small reactors.

In Subcommittee I offered an amendment against an increase in funding for the High Temperature Gas Reactor (HTGR). I do not believe the claims made for the benefits of this reactor technology have been sufficiently proven or that the funding increase for HTGR's can be justified.

The Committee asserts the view that gas reactors are inherently safe and economic. However the property of inherent or intrinsic safety is one of degree and is not absolute. While gas reactors have inherent safety features, in my view and in the view of some witnesses before the Committee, to term a nuclear power reactor as "inherently safe" is misleading and a misrepresentation. No reactor can offer absolute safety and the credibility of the nuclear industry will not be aided by the Committee's use of this term.

It is also probably true that small or modular HTGR's and other reactor types as well could be built with much greater design and construction conformity. However, there must first be a sufficient market to justify the economics of scale that would make such construction attractive and economical.

However, the marketplace may have already rejected HTGRs here and abroad. In fact, 12 orders for HTGR's were cancelled in the 1970's in the U.S. The only HTGR in the U.S. is the 330 MWe Fort St. Vrain HTGR in Colorado. The reactor has operated poorly since 1979 and usually at less than one-half its rated capacity. Because of technical difficulties the NRC has limited it to 70 percent of its capacity.

West German struggles each year to continue funding their THTR and may cancel it. West Germany uses LWR's for power. Both France and Great Britain have stopped building gas reactors altogether and have gone to LWR's.

In addition proponents of these gas reactors have not fully considered the substantial non-proliferation risks presented by

HTGR's. All existing operating HTGR's are now fueled with highly enriched uranium (HEU) that can be used in nuclear weapons. The NRC recently exported over 400 kilograms to West Germany for the HTGR.

The Committee recommends funds for the development of Very High Temperature Reactors (VHTR) to support the needs of heavy industry. Yet, not a single company has stepped forward to express a firm interest in or commitment for such a reactor.

I regard the Committee's actions to support the HTGR over past years as an unfortunate waste of taxpayer's dollars. A clear need for this reactor as evidenced by strong utility industry interest in HTGR technology has never been demonstrated. The lesson in this for the Committee appears very similar to the one learned with the Clinch River Breeder Reactor.

I believe the Committee's newly found interest in the Modular High Temperature Reactor may be premature and unfounded. Once again there is a great risk that another mistake such as the support for the large HTGR for so many years will be repeated. I believe the Committee should require a much stronger and clearer expression of private sector interest in the development of any alternative converter reactor technology as a condition for public support before any further expenditure of taxpayers dollars.

RICHARD L. OTTINGER.

MINORITY VIEWS ON DOE FY 1985 AUTHORIZATION BILL (H.R. 5244)

As members of the House Committee on Science and Technology we traditionally have been strong supporters of the energy programs. We have been very encouraged by the Administration's continued emphasis on basic and applied research, looking to industry for fulfillment of its proper roles in commercializing the developed technologies. This emphasis has been characterized by significant increases in the funding request over the last three years, and the Committee has responded favorably. We believe that such support will maintain the leadership of the United States in the world scientific community. It will also assure advancement of knowledge, leading to new ideas and products and promising enhanced standards of living, both here and abroad.

Despite our support of DOE programs and the philosophy being pursued by the agency, we cannot support this authorization. Even assuming no additions to the President's budget request, the nation is facing a forecasted deficit approaching $200 billion for fiscal year 1985. Any spending increases will simply expand that deficit. The Republican members of the Committee have attempted to hold down expenditures by re-direction of funds to meet Member priorities. It is disappointing that such approaches have not been followed by the majority and that nearly $200 million was added to the U.S. Department of Energy programs above the President's request. No effort to work creatively within the DOE fiscal requests was discerned. This inability to curb excessive spending is not acceptable to us. Therefore, given the deficit crisis facing the nation, we cannot support this proposed budget.

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